Institutional Pushing and Popping

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Abstract:
Economists often model institutions as hierarchies. In this article, I present a general form of the institutional hierarchy by drawing on Herbert Simon, Richard Langlois, and Oliver Williamson. The institutional hierarchy is similar to a tree abstract data type in computer science. Programmers often navigate trees by pushing and popping elements onto the call stack, so I borrow this language for the institutional hierarchy—"institutional pushing and popping." I then apply this lens to institutional entrepreneurship on three different layers of the hierarchy and come away with a notable conclusion: all actions can rightly be seen as both exercising-entrepreneurial-alertness and maximizing-under-constraint, depending only on which level of the institutional hierarchy is emphasized.

Key words:
Institutional hierarchy, institutional entrepreneurs

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1. Introduction

Economists often model institutions as hierarchies: there are the "rules of the game" and then the "play of the game"—and many more levels above, below, and in between. But these are *inter*dependent, not independent structures. Moving between levels as theorists, and as economic actors, is important but non-trivial. I propose we borrow language from computer scientists who regularly navigate between interconnected levels of systems.

Computer scientists work with a *call stack*, a kind of working memory, to execute programs. The call stack keeps track of all the steps and sub-steps (routines and subroutines). I argue that navigating the institutional hierarchy can be seen as analogous to navigating a hierarchical program using a call stack. Indeed my conjecture of "institutional pushing and popping" sheds light on the role of the institutional entrepreneur.

Economists since at least Adam Smith have talked about institutions as hierarchies. This project arguably came to its full fruition with Herbert Simon (1962), Richard Langlois (1986), and Oliver Williamson (2000). I'll briefly elicit each of their models, introduce a general institutional form, and then show how a computer scientist would navigate a similar tree-like data structure. I'll then provide three examples of institutional entrepreneurship at different levels of the hierarchy using the lens of "institutional pushing and popping": Albert Edward Foreman from "The Verger", Uber, and pidgin and creole languages. I come away with a notable conclusion: all actions can rightly be seen as both exercising-entrepreneurial-alertness and maximizing-under-constraint, depending only on which level of the institutional hierarchy is emphasized.

2. The Institutional Hierarchy

2.1 Simon, Langlois, and Williamson

Herbert Simon (1962) addresses hierarchy in "The Architecture of Complexity" by painting with broad strokes. He discusses social systems and organizations, yes, but also particle physics, artificial intelligence, and evolutionary biology. Simon views hierarchy as a structural feature of a system, not necessarily a power-relational feature. For example, a book is a hierarchical system that can be decomposed into chapters, sections, paragraphs, sentences, clauses, and words (and even smaller units, as the linguists do). Bodies similarly can be viewed as a whole, as organs, all the way down to parts of cells. On this framing issue, Simon notes, "Just why a scientist has a right to treat as elementary a subsystem that is in fact exceedingly complex is one of the questions we shall take up. For the moment, we shall accept the fact that scientists do this all the time, and that if they are careful scientists they usually get away with it." (468). The point isn't that scientists are wrong if they choose to "stop" before they finish explaining the smallest possible unit, rather the point is that we must be cognizant of the complexities of even elementary units and their inter-level interactions.

On social systems specifically, Simon notes a few different ways one might want to partition. Levels of management in a company is an obvious one—maybe the more familiar use of the word "hierarchy"—but also the density of personal interactions could be used (spouse, family, tribe, nation) or the density of market interactions (final good, inputs, raw materials, labor).

Richard Langlois (1986) takes up Simon's mantel, but he also imports the language of institutions from Ludwig Lachmann: "A social institution is a 'recurrent pattern of conduct' that helps an individual plan by reducing the volatility in the plans of others" (173, internal quote from Lachmann (1971)). For Langlois, his "elementary subsystem" is the individual person. The fact that individual people interpret the world through a hierarchical structure is all important, then: "if both the agent's plans and his perceptions of events are hierarchical in nature, so also are institutions" (185). In other words, the wider the scope of an action, the wider the scope of the relevant institution. For example, I would approach a decision (action) differently if it affects only me and my family than if it would affect you and yours, or the whole state or nation.

But Langlois is exactly interested in the obvious holes in the institutional hierarchy. He borrows the term *genuine* (or radical) *uncertainty*, meaning "uncertain not merely about which possible states of the world will occur but also about which states are even possible" (181). The question then becomes "what are you genuinely uncertain about?" or conversely, "which part of the institutional hierarchy is incomplete?"[2] As Langlois says, "the appearance of genuine
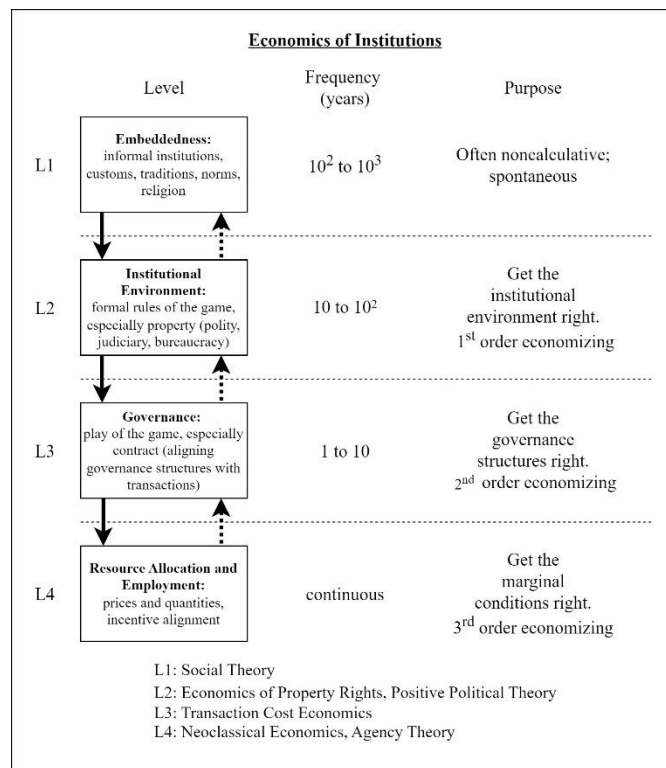

Figure 1: Williamson's Hierarchy

[2] See Shera (2022 *working paper*) on "institutional incompleteness."

uncertainty at a newly recognized lowest level of the hierarchy causes no problems…It is the appearance of genuine uncertainty at the higher levels that is troublesome" (188).

Oliver Williamson (1975, 1998, 2000) carries on the institutions-as-hierarchies tradition with a nice visual illustration (reproduced here as *Figure 1*). His model has four levels: Embeddedness, Institutional Environment, Governance, and Resource Allocation and Employment. Most economic analysis takes place at Levels 3 and 4, Williamson claims, while Levels 1 and 2 are much discussed, very important, and yet poorly understood.[3] Like Langlois's model, each level serves as a frame around a kind of action, and each kind of action varies in scope. The solid downward facing arrows indicate constraints, while the dashed arrows indicate feedback—Williamson admittedly neglects this feedback, a point I return to. The hierarchy is evident and agreeable. Indeed Williamson does us a service with the clean and incisive diagram, but as with all models, we mustn't forget the messiness and complexity of the thing it represents.

2.2 A General Form

I reproduce Langlois's (1986, 195) visual model here as *Figure 2* to show my basis for a general form. For Langlois, each X is a possible event to the acting agent, with many branches (contingencies). I interpret the dashed curves as "known unknowns," where the agent could imagine this category of events but no further offshoots. Thus "unknown unknowns" or radically uncertain events are simply absent from the diagram—they would be X_7 and subsequent X's, or any absent X_{ij} or X_{ijk}.[4]
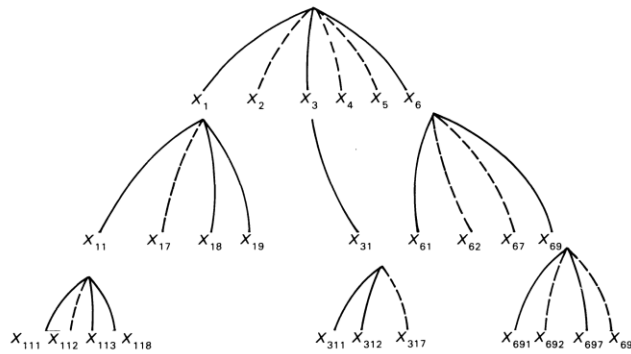

Figure 2: Langlois's Possibility Set

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[3] See Langlois (2017).

[4] Here's a great example from Langlois: "If we view radical uncertainty in the way I suggested above, it is always possible to redefine the set of events so that what was an unanticipated event falls into an anticipated category. 'Give me an example of an unanticipated event,' my interlocutors demand. How about the Trojan Horse? 'That's just a military "trick"; tricks are a concept the Trojans were familiar with, and they could have anticipated that kind of strategy and assigned a probability to it.' Well, consider the many possibilities attendant on the introduction of a technical innovation. Surely some possibilities can't be anticipated? 'Just divide the world into two events: "innovation succeeds" and "innovation fails." These are well-defined, collectively exhaustive, and naturally exclusive events over which we can define probabilities.' I had always consigned this kind of discussion to the realm of 'paradigmatic' mutual incomprehension. But the point, of course, is that the category problem is not just an intellectual game. It reflects the fact that events are normally *both foreseeable and unforeseeable at the same time*" (181-2).

My general form (presented here as *Figure 3*) is quite similar to Langlois's. However, it is not about an individual's subjective view on possible events. Rather, the X's are meant to represent the "rules of conduct" themselves—the institutions. With Langlois, I agree it is meaningless to refer to institutions without incorporating the subjective expectations of the agents. However, I believe drawing a general diagram is helpful, though not perfectly objective.

The general form (*Figure 3*) noticeably has four layers, so we could start by letting it represent Williamson's four Levels. The highest rule of conduct (X_1 or L1) could be an embedded norm, for example that of "reciprocity in interaction" (e.g., returning facial expression, matching tone). The second highest (X_{11} or L2) could be "follow national law." Then (X_{111} or L3): "fulfill labor contract." And then (X_{1111} or L4): "leave house to arrive at work on time."
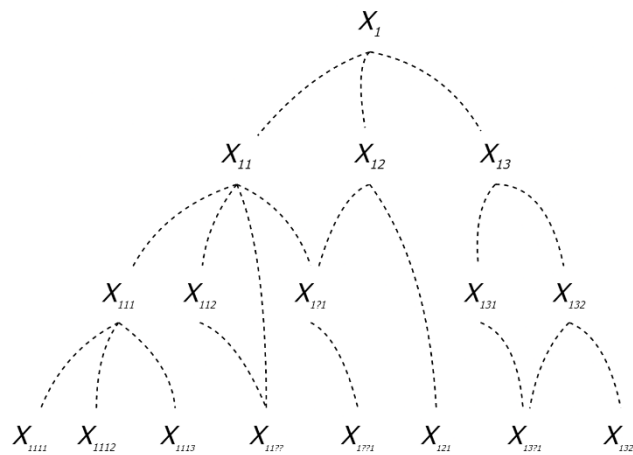

Figure 3: A General Form of Institutional Hierarchy

But *Figure 3* can also be interpreted as a hierarchic *structure*, as in Simon's sense. That is, we could "zoom in" on X_{111} and see that it looks just like X_1. To use Williamson's language again, there is embeddedness within the governance level—there are informal, inarticulate norms to fulfilling your labor contract. Furthermore, X_{1111}, X_{1112}, and X_{1113} can take the form of the X_{ij}'s as Level 2 institutions—this would be your formal written labor contract. And so on.[5] To reiterate the point, whichever system we choose to frame the boundaries of our analysis, further inspection will always reveal more layers to the institutional hierarchy—both above and within. A university, firm, nation, household, "social movement," or club—they will all have their own informal rules, formal rules, play of the game, and base level optimization *within* their span. At the same time, each can play one of these roles within a broader framework.

There are some non-normal branches to the general form: the X's with multiple parents and branches that skip a layer. This is just to show that real world institutions aren't always perfectly fractal; it isn't always clear which layer of rules an action should follow. The lines are

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[5] The structure resembles a Barnsley Fern and other self-similar objects. See Appendix.

also dashed to indicate the malleability of the structure, because again, I am claiming this is a subjective image that actors generate.[6]

2.3 Other Examples: Greif and Leeson and Boettke

Additional to Simon, Langlois, and Williamson, I find two more views of institutional hierarchy particularly helpful: that of Avner Greif (2006) and Peter Leeson and Peter Boettke (2009). Greif has a unique (but growing in popularity) definition of institutions: institutions are "self-enforcing equilibria." This he takes from the notion in game theory of a (Nash) equilibria where, upon the players' arrival, it needs no external enforcement. But how do people arrive at these self-enforcing equilibria institutions in the first place? By means of "institutional elements," Greif argues. Institutional elements are the layer below the institutions that can sustain the equilibrium or potentially move the equilibrium. And "when an institution ceases to be self-enforcing and no longer generates a particular pattern of behavior, its institutional elements provide some of the initial conditions in the process leading to a new institution" (Greif and Laitin 2004, 649).

In their paper "Two-tiered Entrepreneurship and Economic Development," Leeson and Boettke (2009) ague that entrepreneurship exists both *within* a given institutional framework and *over* the institutional framework. In their terminology, there is a productive tier concerned with arbitrage, and there is a protective tier concerned with securing private property rights. This latter group they deem "institutional entrepreneurs." I see this roughly matching Williamson's levels— the protective tier sits approximately between Levels 2 and 3, while the productive tier sits between Levels 3 and 4. Although Leeson and Boettke are focused on development contexts, the acknowledgment of the entrepreneur's role in institutional change is important. I return to this topic in Section 4.

3. Computer Science and Hierarchies

When computer scientists run (compile) a program, an important component is the *call stack*. The call stack acts as a working memory for what steps must be taken next and takes the form of a *stack* abstract data type (ADT)[7] (see *Figure 4*). Elements can be added or removed from stacks but only from the top. The operation to add is *push* and the operation to remove is *pop*. In the context of a call stack, to push would mean "start this routine or operation" and to pop would mean "complete this routine or operation." Many routines have subroutines, and thus another action gets added (pushed) and must conclude (pop) before the main routine can be completed.

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[6] Perhaps when people navigate their structure through time, the lines become thicker as a "rule of conduct proves" to align expectations with reality. For example, after the first couple lectures, students find the seating chart (though initially arrived at informally) all but set in stone.

[7] Data structures and abstract data types are ways (rules) to arrange data in space.
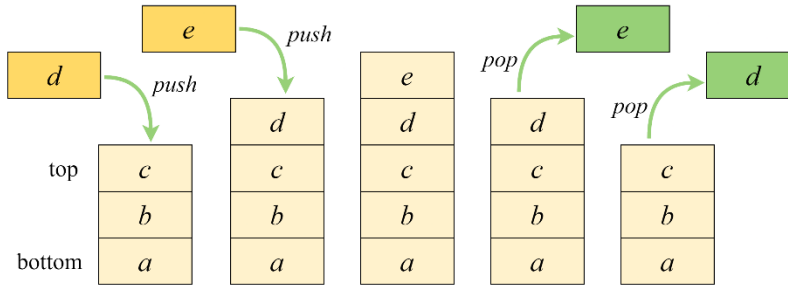
Figure 4: Stack ADT

For example, consider a cookie recipe as a program:

> *Step 1: Preheat oven.*
> *Step 2: Mix melted butter, sugar, and brown sugar. Beat in eggs, vanilla.*
> *Step 3: Separately combine dry ingredients: flower, baking soda, salt.*
> ...

If the call stack is the "actions open sitting on the counter," a list of actions might look like:

> *Push →*
>> Step 1: Preheat oven.
>> *←Pop*
> *Push →*
>> Step 2: Mix melted butter, sugar, brown sugar. Beat in eggs, vanilla.
>>> *Push →*
>>>> Melt butter.
>>>> *←Pop*
>>> *Push →*
>>>> Mix butter, sugar, brown sugar.
>>>> *←Pop*
>>> *Push →*
>>>> Beat in eggs, vanilla.
>>>> *←Pop*
>> *←Pop*
> *Push →*
>> Step 3: Separately combine dry ingredients: flower, baking soda, salt.
>> *←Pop*
> ...

Notice how Step 2 has sub-steps that were each separately pushed onto the call stack before returning to the main recipe. You could even imagine a recipe that broke down each step further and more specific (retrieve mixing bowl, melt butter in microwave for 10 seconds, crack eggs)—that would require more "pushing onto the stack" before popping back out to the main recipe.

Sometimes computer scientists find it useful to store data hierarchically in the form of a *tree* abstract data type (see *Figure 5*).[8] Trees are most often optimized for searching through large amounts of data quickly. Your file system on your computer, for example, is a tree ADT. The topmost (root) node is the "File Explorer" icon,[9] each folder is a child starting its own

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[8] Note the similarity to *Figure 3*.
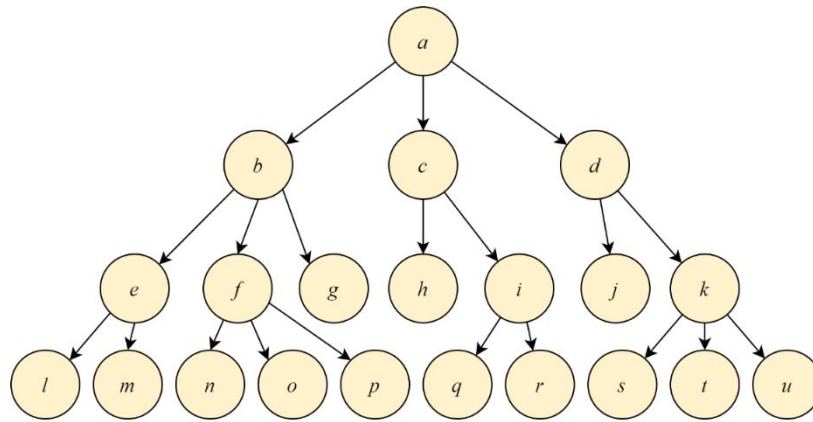[9] On PC of course. It's "Finder" on Mac.

Figure 5: Tree ADT

branch, each child can have their own children (and so on), and finally the files and documents themselves are the bottommost (leaf) nodes.

When a tree is stored, each node has a list of data points. There is a point for the value of the node itself (the lower-case letters in *Figure 5*), a point for each of its children (normally from left to right), and occasionally a point for its parent.[10] Often to transverse or search a tree, a computer scientist will use a recursive algorithm. For example, to find a specific letter, say *g*, in *Figure 5*:[11]

Definition: Find *g*
    If node = *g*, return value and stop.
        Else move to leftmost child and perform (Find *g*)
        Else move to next leftmost child and perform (Find *g*)

When running this "program" the call stack would look like:

Push →
   a
  Push →
     b
    Push →
       e
      Push →
         l
         m
        ←Pop
     f
     Push →
        n
        o
        p
       ←Pop
     g

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[10] There are certainly many implementation techniques, and this is a simplification.
[11] This resembles what is called a "pre-order" implementation where the root node of a given tree (or subtree) is searched before its children.

Now with this very elementary introduction to computer science language, let us revisit the tree of institutional hierarchy, *Figure 3*. Moving between layers of the hierarchy is what I will now call "institutional pushing and popping." For example, if we start our unit of analysis as a "family" and then shift the frame to a "tribe," that would be an *institutional pop*. If we start with the "computer industry" and then shift the frame to "IBM," that would be an *institutional push*. Although this is interesting and perhaps helpful for general economic explanation, the more interesting and more important angle is from the entrepreneurs' perspective. I highlight three examples below.[12]

4. Three Examples of Entrepreneurship via Institutional Pushing and Popping

4.1 The Verger

The character of Albert Edward Foreman was originally a church minister in "The Verger," a short story of once-popular writer W. Somerset Maugham (1937). The story goes that clergy Foreman was ousted from his position when he was found to be illiterate. Though not a smoker, a somber Albert found himself walking down a long street craving a cigarette. Coming up empty and at the same time looking for a new occupation, Albert vows to open a new tobacco shop.[13]

A standard rendering of The Verger is good-old Kirznerian entrepreneurship.[14] Albert was alert to a profit opportunity in a certain place and time. Another angle is to see Albert as an institutional entrepreneur. He was originally in a "maximize on the margin" framework: "satisfy craving for cigarette" was his goal. But then he popped up the institutional structure (to something like Williamson's Level 3) and took on a new economic problem—why are there no tobacco shops here? His alertness was first and foremost making the jump to the higher level. In his mental model of the hierarchic institutional structure (something like *Figure 3*), he is drawing a new branch. His entrepreneurship wasn't ex nihilo: he knew what tobacco shops were like and he knew there could be shops on that road. Indeed, as the story goes, he opened up many shops around the country—at that point he even knew *how to run* a tobacco shop. It was only because Albert was in the layer of the hierarchy directly below the missing institution that he could pop up the structure. He did *not* after all open up a barbershop because he was *not* in a "get a haircut" maximization framework.

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[12] My references for Section 3 are Hofstadter (1979), Main and Savitch (2011), and youtube.com/mycodeschool.
[13] See Klein's (2012) *Knowledge and Coordination* for his original use of "The Verger" in explaining entrepreneurship.
[14] See Kirzner's (1973).

4.2 Uber

The Uber story is a favorite among economists.[15] Partly, I suspect, because the taxi industry with their famous taxi medallions has always been a favorite. Uber, to mesh it into my framework, is another example of entrepreneurship by institutional popping. Uber does not supply cars for people to travel in—that would be economizing on the same level as the taxi drivers and bus companies. Uber in fact is in the business of market governance: they supply a set of rules for others to maximize under.[16]

The company had its beginnings supposedly when cofounder Garret Camp was frustrated after spending $800 for a personal driver one evening.[17] But again, Camp (and other cofounder Travis Kalanick) did not resort to being personal drivers themselves—even though there may have been a relatively short supply. They were in the world of tech startups; of course they were going to use the tools they knew how to use. They had heard of eBay, a platform that matches buyers and sellers. They had heard of taxis. Camp and Kalanick's entrepreneurial alertness, then, wasn't *being dissatisfied with a maximizing action*—anyone can do that.[18] It was making the connection that the problem could be solved by popping up the institutional hierarchy. And realizing that their product is "reducing transaction costs by opening a marketplace with secure property rights," Uber easily expanded their span to non-ridesharing services.

4.3 Pidgin and Creole Languages

My final example is *pidgin* and *creole* languages, languages that originate from "stripped down" versions of other languages mixing and then re-evolving. Take for example Saramaccan, a maroon creole language spoken in Suriname.[19] It is primarily English and Portuguese-based, with words from various African languages including Gbe and Kikongo (Good 2009). The original speakers came together as a group between 1690 and 1720.

This new language formed first as a pidgin—multiple distinct groups of (adult) people, each with their own native language, interact without a common way to communicate. Out of necessity they formed a mixed language by borrowing bits and pieces of the various inputs. But just as a new language learner starts with the most basic constructions, so too do early pidgin speakers. The pidgin is said to go through *creolization a*fter a generation of adult speakers raise children *in* the new mixed language (even if they also receive their parents' native tongue), (McWhorter 2005). New accents, inflections, tones, and grammatical constructions develop, as in any evolving language.

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[15] See Munger (2018) and Elert and Henrekson (2016). The sharing economy more broadly fits into this analysis also.

[16] Thus Uber is arguably a Level 2 institution in Williamson's hierarchy.

[17] See Shontell (2011). Notice the similarity to story in "The Verger": a dissatisfaction in one framing of the hierarchy leads to a reframing via entrepreneurship.

[18] That is why demand curves slope downward.

[19] Saramaccan and other "maroon" creoles originated with a group of runaway slaves escaping to the rainforest.

In my framework, I argue that original pidgin speakers—the runaway slaves in Suriname—were faced with a gap in the institutional hierarchy. To fill the gap, in one sense they *popped* up the structure to what is known as "universal grammar," the human genetic "rules" for processing natural language (Chomsky 1965). But in a more literal sense, they *pushed* down the structure in a variety of ways. They had a need (a propensity?) to trade with each other and to work together in an unfamiliar environment. These lower level maximization problems were surely difficult without a higher level institution of a shared language, but the higher level institution of the pidgin (and later creole) wouldn't have formed without lower levels supporting it. *This* is the kind of "feedback" Williamson means with his upward facing dashed arrows. Indeed pidgin languages commonly disappear when shared cross-language interaction ceases. Also note that the new language wasn't made from scratch—the pidgin speakers took already-used words and constructions to form the new language.[20] This too constitutes an institutional push.

5. Conclusion

In sum, the institutional hierarchy can be represented as an approximately self-similar tree. Navigating the tree (as analysts or economic actors) can be seen as analogous to how computer scientists navigate a tree abstract data type via code going through the call stack. Thus, the inception of institutional pushing and popping—pushing down the hierarchy or popping up it.

Though this article is limited in its contribution to pure theory—I simply mixed the language of economics with some elementary parts of computer science[21]—I believe it does give us a new lens to view institutional hierarchies and entrepreneurial actions. A first-order question would seem to be: under what conditions do entrepreneurs tend to push or pop through the hierarchy to solve a problem? Or: what kinds of problems could be solved if it were easier to push or pop through the hierarchy? But these might be unanswerable because of the original framing problem. After all, a basic implication of the structure of the hierarchy is this: all action can be viewed as maximizing-under-constraint so long as we frame the action in a higher layer of the institutional hierarchy. Likewise, all action can be viewed as exercising-entrepreneurial-alertness if we zoom in sufficiently to see the actor bridge an institutional gap. I don't claim to have a solution to this framing problem; I can only echo Herbert Simon in saying "the careful scientists get away with it" (1962, 468).

However, I do hope that introducing the language of *institutional pushing and popping* can help economists make sense of the success of bottom-up or top-down solution in different problem situations.[22] Is this a situation where there is known uneasiness in an obvious maximizing-framework, like craving a cigarette? Is this a situation where property rights are

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[20] In Greif's framework: the old institutional elements are necessary to find the new equilibria institution. See also Boettke, Coyne, and Leeson (2015).

[21] Not the beginning of a pidgin language, unfortunately.

[22] See Ostrom (2010).

broadly ill-defined, but collective action seems unfeasible? Or is this a situation where incentives align across lower-level institutions, but it is unclear if they align further up the structure? We can start to make progress on these questions by identifying the relevant actors and their varying internal models of institutional hierarchies.[23]

Two more inter-field questions are raised when considering this framework. Firstly, we have mostly reserved the inquiries of Public Choice economics and Constitutional Political Economy for studying the behavior of governments. But if I am right to notice that setting a government organization as the highest-level rule setter is simply a choice in framing, then each organization that is itself a rule-setter can be the subject for these methods. What are the rent-seeking consequences of fixed long-term contracts, for example? How do CEO elections compare with presidential elections? Secondly, how do actors in and among the different layers deal with calculation? Economic calculation—profit and loss accounting—seems applicable only to the bottom layers of the hierarchy (Williamson's Levels 3 and 4), but are institutional entrepreneurs finding relevant shadow prices for the higher layers, and if not, how do they justify their entrepreneurial activity? And when they do succeed, how do they internalize their added value?

If this exposition of institutional pushing and popping does have a testable implication, it is this: given a wide enough scope of predictability—a sturdy "highest" level institution—institutional entrepreneurs will find ways to fill in the intermediate and lower levels. Another open question then becomes: what is a sturdy enough and high enough institution?

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[23] "Identifying internal models" of course is all but meaningless. We can often guess fairly accurately however: Pennsylvanians normally speak English and follow federal law, teachers normally dismiss class at the bell, employees normally collect their paychecks. In fact, because my mental model of the institutional hierarchy pragmatically *works* for me—I can navigate the world—it is probably safe to say other people—who can navigate the world—share a similar model. See Hayek (1943).

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Appendix

Figure 6: Barnsley Fern