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Concatenate coordination and mutual coordination

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ABSTRACT

We tell of the evolving meaning of the term *coordination* as used by economists. The paper is based on systematic electronic searches (on “coord,” etc.) of major works and leading journals. The term *coordination* first emerged in professional economics around 1880, to describe the directed productive concatenation of factors or activities within a firm. Also, transportation economists used the term to describe the concatenation of routes and trips of a transportation system. These usages represent what we term *concatenate coordination*. The next major development came in the 1930s from several LSE economists (Hayek, Plant, Hutt, and Coase), who extended that concept beyond the eye of any actual coordinator. That is, they wrote of the concatenate coordination of a system of polycentric or spontaneous activities. These various applications of concatenate coordination prevailed until the next major development, namely, Thomas Schelling and game models. Here coordination referred to a mutual meshing of actions. Game theorists developed crisp ideas of coordination games (like “battle of the sexes”), coordination equilibria, convention, and path dependence. This “coordination” was not a refashioning, but rather a distinct concept, one we distinguish as *mutual coordination*. As game models became more familiar to economists, it was mutual coordination that economists increasingly had in mind when they spoke of “coordination.” Economists switched, so to speak, to a new semantic equilibrium. Now, mutual coordination overshadows the older notion of concatenate coordination. The two senses of *coordination* are conceptually distinct and correspond neatly to the two dictionary definitions of the verb *to coordinate*. Both are crucial to economics. We suggest that distinguishing between the two senses can help to clarify “coordination” talk. Also, compared to talk of “efficiency” and “optimality,” concatenate coordination allows for a richer, more humanistic, and more openly aesthetic discussion of social affairs. The narrative is backed up by Excel worksheets that report on systematic content searches of the writings of economics using the worldwide web and, using JSTOR, of *Quarterly Journal of Economics*, *Economic Journal*, *Journal of Political Economy*, *American Economic Review*, and *Economica*.

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Coordination has been said to be *the* economic problem that needs to be explained (Knight, 1951, p. 6; Leijonhufvud, 1981, pp. 321–322). But what does *coordination* mean? Adam Smith addressed one form of coordination when he described the concatenation of activities producing a woolen coat (Smith, 1976 [1776], p. 22). But Smith never used the term *coordination*. To our knowledge, it was not until the 1880s that the term *coordination* appeared in economics. The history may be summarized as follows:

- Beginning in the 1880s, *coordination* was used to describe the effective arrangement of activities within a firm. The referent concatenation would be the array of factors and activities within the firm.

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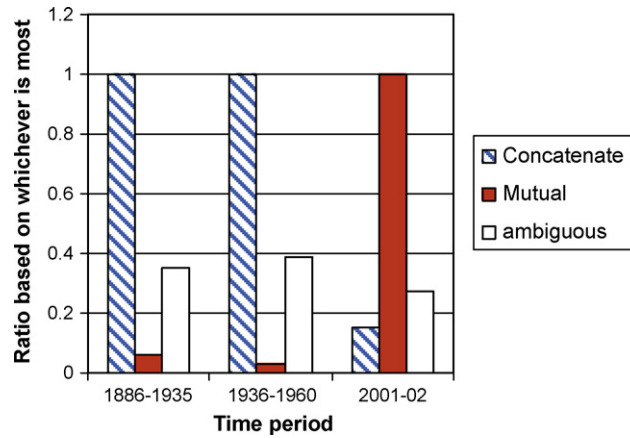


Fig. 1. For a long time concatenate dominated, but now mutual does. Source: JSTOR searches of AER, Economica, EJ, JPE, and QJE.

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Fig. 2. Mutual coordination: a coordination problem with two coordination equilibria.

- In the early 20th century, *coordination* was extended beyond the firm, to describe the pleasing arrangement of activities within the entire economic system—like Smith’s discussion of all that goes into the making of the woolen coat. Here, the referent concatenation would be a much wider skein of factors and activities, even the global economy.
- Beginning around 1960, with Thomas Schelling and game models, *coordination* took on another meaning: mutual meshing of actions, one to another. In the ensuing decades the mutual idea of coordination caught on and became focal.
- Nowadays, the idea of mutual coordination overshadows concatenate coordination. Also, the two are sometimes conflated.

Here we provide a narrative and empirical evidence for it. Fig. 1 summarizes the findings based on JSTOR searches of five major general economics journals. Earlier, the dominant usage of “coordination” was concatenate, but in 2001–2002 it was mutual. We discuss the figure later—here we just want to flash the dramatic reversal.

1. The two coordinations

The dictionary gives two definitions of the verb *to coordinate*. One is transitive and the other is intransitive. (Transitive verbs take direct objects, while intransitive do not.)

An interior designer coordinates colors, patterns, and textures to make a pleasing look. The businessperson coordinates factors to make profits. The verb is transitive and the result is an overall pleasure from the perspective of the coordinator or of anyone else like her. Components link one to another, forming a chain or concatenation. Call it *concatenate coordination*.

Then there is the intransitive verb: the Japanese drive on the left, and one *coordinates* to that convention (no direct object there). Call that *mutual coordination*. Mutual coordination is usually more or less manifest, like waltzing together. Actors might not be thinking about it, but they are potentially made aware that they are taking part in mutually coordinated action.¹

Concatenate coordination refers to a concatenation, and the referent concatenation depends on what we are focusing on—we can “zoom in” and “zoom out.” Concatenate coordination can describe the skeleton of activities within a firm, where affairs are coordinated “top down,” but it can also describe the pleasing quality of a wider skein of affairs lacking any top-down direction. In either case, improvements can be described as better coordination.

Mutual coordination describes mutually intermeshing behavior: given what you are doing, my behavior is best for me; and, given what I am doing, your behavior is best for me. Mutual coordination is commonly depicted as a coordination game where there are at least two coordination equilibria (Lewis, 1969, p. 8), as in Fig. 2.

¹ The distinction between the two coordinations is set out in Klein (1997, 1998). The present discussion concurs entirely with those papers, however, here we use different nomenclature. What is here called “concatenate coordination” was called “metacoordination,” and what is here called “mutual coordination” was called “coordination” (*simpliciter*).

Suppose that because of the driver-seat location in our cars we both get higher payoffs by both driving on the right than by both driving on the left. Driving on the left, yielding payoffs (1, 1), is less pleasing in a concatenate sense—it is the lesser in *concatenate* coordination. But in the *mutual* sense, everyone driving on the left is just as coordinated as everyone driving on the right. An inefficient coordination equilibrium generally holds a sort of intermediate position in terms of concatenate coordination: though inferior to some other coordination equilibrium, it will generally be better than possibly relevant outcomes lacking mutual coordination—better that we suffer the inconvenience of driving on the left than that we run the risk of colliding.

One might say: “So concatenate coordination is essentially efficiency, right?” In our view, there are very good reasons to resist such a translation. Terms like “efficiency” and “optimality” suggest a clearly defined maximand or objective function or social-welfare function, while concatenate coordination allows considerations in the realm of the aesthetic. When discussing beauty or goodness in an aesthetic way – for example, after we have become familiar with a piece of music – we do not pretend to a well-defined standard or criterion. We do not invoke a specific “music excellence function,” nor even entertain the notion of such a thing. Moreover, as we discuss the piece of music, we not only enhance our appreciation of that piece of music, we also cultivate our sensibilities of *what is beautiful* in music. Likewise, “coordination” talk (in the concatenate sense) readily allows the discussion to open up, explore, debate, and reform *our sensibilities* of what is good or beautiful in society, while “efficiency” talk restricts itself to instrumentalities, not questioning the maximand. With “coordination,” we not only discuss instrumentalities, but also excavate our respective notions of *the mind imagined to behold and aesthetically react to the concatenation*. Both ends of the conversation are being explored and refined in conjunction with one another.

The two coordinations are conceptually and empirically distinct. Enhancements in concatenate coordination do not necessarily entail enhancements in mutual coordination. In fact, enhancement in mutual coordination might diminish a relevant frame of concatenate coordination, for example, when firms collude or predators conspire.

But the two interrelate. In a relay race, a team’s complete run is a kind of concatenate coordination, but the baton pass is a moment of mutual coordination. In a firm, there is the boardroom “big picture”—the aspirational concatenation is called “*the plan*.” But in the firm there are also myriad instances of mutual coordination, both among workaday interactions and among longer term habits, attitudes, and plans. The referent concatenation subsumes many instances of mutual coordination.

Also, the referent concatenation might, in the eyes of the “chiefs,” correspond closely to the mutual coordination among them. Suppose the owner of a golf course and the owner of a golf school sit down together to cooperate in how they will jointly operate their businesses. From the Schelling point of view, each has his individual interests, and each mutually coordinates his own plans and actions with those of the other.² However, there is also a sense in which *the two form a cooperative unit* (variously termed the *team, group, association, partnership, consortium, cartel, ring, cabal*, etc.) that coordinates the set of activities (golf facilities and golf instruction) in the concatenate sense. But any such “isomorphism” between the two coordination may hold only when the mutual coordinators are also the “chiefs” of the referent concatenation.

Further unfolding concatenate and mutual coordination is found in two appendices. Appendix A shows how the distinction clarifies the concept of cooperation. Appendix B shows how the distinction between central and decentralized action applies to each kind of coordination. But we now turn to the history of *coordination* in economics.

2. In the beginning: concatenate coordination within the firm

As detailed in the Excel file,³ we have searched not only five major journals but also the New School’s history of economics website and the Liberty Fund “Library of Economics and Liberty” website—in all, well over 100 works covering many of the main works of political economy.

We were quite surprised to find that terms of “coord” or “co-ord” scarcely occur anywhere prior to 1880, and when it does it often is used in ways not relevant. There are a few pre-1880 occurrences by Herbert Spencer in *First Principles* (1862), where he extends biological ideas to social theory, by likening the coordination of parts of an organism to the coordination of parts or functions of a society. Spencer was significant in advancing *coordination* in the social sciences. We find a small number of interesting occurrence shortly after 1880 in the Spencer-like biological line of thought, for example in Newcomb (1886), Karl Marx (in works likely written years prior to publication), George Bernard Shaw, Sidney Webb, and Franklin Giddings. But this line does not gel in economics.

It is appropriate, we think, to highlight Simon Newcomb’s usage of *co-ordination* as the first significant and squarely “economic” occurrence. Known more as an astronomer and mathematician, Newcomb brought a new perspective to economics. John Maynard Keynes (1930, p. 209, n. 1) described Newcomb’s *Principles of Political Economy* (1886) as “one of those original works which a fresh scientific mind, not perverted by having read too much of the orthodox stuff, is able to produce from time to time in a half-formed subject like economics.” Newcomb’s *Principles* emphasize the idea of the social organism, highlights

² We said that mutual coordination derives from the intransitive usage of *to coordinate*, and yet it seems that the verb here is taking a direct object: “each mutually coordinates his own plans and actions.” However, the direct object is reflexive—it is oneself (or a part of oneself). In general, intransitive usages can be made formally transitive by putting in a reflexive object. For example, the intransitive “I walk down the street” can be made transitive as “I walk my body down the street.” To make the point another way, notice that we could have instead written the clause in question as the intransitive by eliminating the reflexive objects, leaving “each mutually coordinates with the other.”

³ The Excel file is online at <http://www.gmu.edu/departments/economics/klein/Assets/Coord5.xls>.

Spencer's formulation of social progress (p. 141), and on a single page (138) uses the term *co-ordination* in the concatenate sense.

But it is Newcomb's earlier usage that we wish to highlight. In "The Organization of Labor" published in the *Princeton Review* in 1880, the term *coordination* is introduced in the following passage:

As society advances we find great changes both in the fundamental ideas on which organizations rest and in the objects for which they are intended. We must expect that, as a rule, each society will tend to the form best adapted to its preservation and efficiency under all existing conditions both internal and external. Now, in an advanced state of society these ends can be attained only by the formation of organisms having perfect co-ordination among the functions of their members, and there are certain conditions under which this co-ordination cannot be secured except by a system of subordination not in unison with the ideas of equal rights now prevalent. (Newcomb, 1880, p. 395)

Activities must be coordinated top-down to produce a pleasing outcome. The members of an organization must be subordinate to the coordinator:

With every increase in the number of persons co-operating, and in the delicacy of the material and instruments employed, comes an increased necessity for a precise co-ordination among the efforts of all. Thus there grows up an organization which in its outward form is more like a well-disciplined army than like a collection of individual producers of past centuries. (Newcomb, 1880, p. 398)

In the decades after 1880 we find increasing occurrences of *coordination*. We have used JSTOR to search five lead journals: *Quarterly Journal of Economics* (begun 1886), *Economic Journal* (1891), *Journal of Political Economy* (1892), *American Economic Review* (1886/1908/1911, including precursor AEA publications), and *Economica* (1921). The results show that coordination meant concatenate coordination (with some occurrences of ambiguous or extraneous usage). During the early period, the focus is on the entrepreneur/owner/manager as the coordinator of activities and factors within the firm. Leading figures in the discussion are Newcomb, Frederick B. Hawley, John Bates Clark, Thorstein Veblen, Frank H. Knight, and Austin Robinson.

For example, John Bates Clark in *The Distribution of Wealth* (1899) had the following to say in discussing how income is divided up:

The function of this natural law . . . causes the whole annual gains of society to distribute themselves into three great sums—general wages, general interest and aggregate profits. These are, respectively, the earnings of labor, the earnings of capital and the gains from a certain coördinating process that is performed by the employers of labor and users of capital. This purely coördinating work we shall call the *entrepreneur's* function, and the rewards for it we shall call profits. The function in itself includes no working and no owning of capital: it consists entirely in the establishing and maintaining of efficient relations between the agents of production. (Clark, 1899, pp. 2–3)

Like Newcomb, Clark is talking about top-down concatenate coordination within the firm. The discussion was joined by Frank Knight, who, in *Risk, Uncertainty, and Profit* (1921) says "[t]he entrepreneur is the owner of all real wealth, and ownership involves risk; the coordinator 'makes decisions,' but it is the entrepreneur who 'accepts the consequences of decisions'" (1921, p. 45). Thusly, leading economists focused on top-down coordination within a firm, and debated how to distinguish certain functions and the returns they earned.

3. Other early occurrences

3.1. Transportation

Our investigation finds another batch of early *coordination* occurrences among transportation economists, who speak of the coordination of facilities and trips. Again the meaning is concatenate. The discussion appears to have proceeded largely independently of that about the firm. For the most part, the transportation occurrences speak of a top-down process of transportation-system planning.⁴

3.2. Coordination of the laws of distribution

We must note one other batch: numerous economists used the expression "coordination of the laws of distribution" to describe the working out of compatible theories of economic value and earnings.⁵ Within our search results, this usage pretty much dies out by 1907.

⁴ One very interesting piece, however, Peterson (1930), explores the usages of *coordination* within the transportation literature, and seems to be trying to impress on transportation specialists that the (concatenate) coordination of transportation services does not have to occur by central planning (cf 665, 669–671, 674).

⁵ Wicksteed published a book in 1894, *Coordination of the Laws of Distribution*; other authors (see Excel file <http://www.gmu.edu/departments/economics/klein/Assets/Coord5.xls>) using the term in such fashion are Hobson, 1891; Patten, 1893; Hadley, 1894, 1897; Haynes, 1895; Bohm-Bawerk, 1895; Fisher, 1896; Hollander, 1903; Tuttle, 1903; Tuttle, 1903; Walker, 1904; and Fetter, 1907.

4. The 1930s: LSE economists go beyond the eye of any actual coordinator

Up to around 1930, the primary economic talk of “coordination,” aside from the transportation literature, concerned the concatenation of activities within the firm. But in the 1930s a new moment occurs, and it may be marked by a lecture given by Friedrich A. Hayek in 1933 at the London School of Economics and published that year in *Economica* as “The Trend of Economic Thinking.” Hayek takes *coordination* to the extensive economic cosmos. This step was not entirely novel,⁶ of course, but it now becomes front and center in Anglo-American economics. The LSE during the 1930s seems to have bubbled with talk of coordination beyond the firm.

In the lecture Hayek extends the idea of concatenate coordination beyond the eye of any actual coordinator:

From the time of Hume and Adam Smith, the effect of every attempt to understand economic phenomena – that is to say, of every theoretical analysis – has been to show that, in large part, the co-ordination of individual efforts in society is not the product of deliberate planning, but has been brought about, and in many cases could only have been brought about, by means which nobody wanted or understood, and which in isolation might be regarded as some of the most objectionable features of the system. (Hayek, 1933, p. 129)

Hayek is describing independent actions that lead to outcomes beyond the actor’s intention and comprehension. What Hayek is discussing is spontaneous order or, in our nomenclature, undirected concatenate coordination. Like the concatenate coordination within the firm, coordination means desirable arrangement or outcome. But, *desirable to whom?*

The matter, Hayek emphasizes, calls for great delicacy. He suggests that society has a “sense” like an “organism,”⁷ yet he makes the suggestion with great caution. Classical liberals such as he dread the hazards of any society-as-organism metaphor. He notes: “The limitations of language make it almost impossible to state it without using misleading metaphorical words” (p. 130). The lecture is quite remarkable as an early expression of the dilemmas in opposing society-as-organization notions while trying to say that liberal processes are coordinative. But, coordinative to whom? In the case of the firm, the answer is clear—the owners/managers. But for a polycentric spontaneous system, there is no tangible analog.

Here, we suggest a fictitious impartial mind able to behold the extensive tapestry of social affairs, and inclined to judge it in a manner that parties to the discourse situation are presumed to find acceptable. This imagined judge is like that being whose hands, according to Adam Smith, are invisible. Alluding to Hume and Smith, Hayek too wants to talk about coordination beyond the eye of any actual human coordinator.

At about the same time, similar ideas were being explored at the LSE, by Arnold Plant, W.H. Hutt, and Ronald Coase.⁸ Ronald Coase was writing his seminal article “The Nature of the Firm,” drafted years prior to publication in *Economica* in 1937. In it he says, “An economist thinks of the economic system as being co-ordinated by the price mechanism, and society becomes not an organization but an organism” (Coase, 1988 [1937], p. 34). Coase is noting what Hayek had been discussing and emphasizes that at one level prices help to coordinate economic activity. But Coase makes another observation:

Marshall introduces organization as a fourth factor of production; J.B. Clark gives the co-ordinating function to the entrepreneur; Knight introduces managers who co-ordinate. As D.H. Robertson points out, we find “islands of conscious power in this ocean of unconscious co-operation like lumps of butter coagulating in a pail of buttermilk.” But in view of the fact that it is usually argued that co-ordination will be done by the price mechanism, why is such organization necessary? Why are there these “islands of conscious power”? Outside the firm, price movements direct production, which is co-ordinated through a series of exchange transactions on the market. Within a firm these market transactions are eliminated, and in place of the complicated market structure with exchange transactions is substituted the entrepreneur-co-ordinator, who directs production. It is clear that these are alternative methods of co-ordinating production. Yet, having regard to the fact that, if production is regulated by price movements, production could be carried on without any organization at all, well might we ask, Why is there any organization? (Coase, 1988 [1937], pp. 35–36)

Coase is seeing the two levels of concatenate coordination, the unplanned level mediated by prices and the planned level within the firm. On the heels of Hayek’s step beyond the eye of any actual coordinator, Coase writes as though Hayek’s formulation is commonplace and that the outstanding question is why there should be any planned coordination at the level of the firm. He adds:

In view of the fact that, while economists treat the price mechanism as a co-ordinating instrument, they also admit the co-ordinating function of the “entrepreneur,” it is surely important to enquire why co-ordination is the work of the price mechanism in one case and of the entrepreneur in another. The purpose of this paper is to bridge what appears

⁶ Besides some of the writers with Spencer-like biological analogies, other scattered and fleeting occurrence of “coordination” meaning spontaneous concatenate coordination by Henry George, John Bates Clark, Philip Wicksteed, Ludwig von Mises, David Friday, Lawrence Frank, Raymond Bye, and Shorey Peterson may be found in the Excel worksheets.

⁷ On the matter society as organism, Hayek cites the 1923/1932 German language editions of *Mises’ Socialism* (1981). Mises cites Spencer several times, but never in connection with society as organism. Neither Hayek nor Mises cite Newcomb’s *Principles of Political Economy* (1886), but it is noteworthy that Newcomb, like Hayek, articulates cautions while going forward with the organism metaphor (see esp. Newcomb, 1886, pp. 7–8).

⁸ Incidentally, as shown in the Excel worksheets, we were able to search a few of Edwin Cannan’s works, and found no occurrences.

to be a gap in economic theory between the assumption (made for some purposes) that resources are allocated by means of the price mechanism and the assumption (made for other purposes) that this allocation is dependent on the entrepreneur-co-ordinator. We have to explain the basis on which, in practice, this choice between alternatives is effected. (Coase, 1988 [1937], p. 37)

Coase crystallizes concatenate coordination at two levels, the extensive economic system and the individual firm.

Coase may have treated Hayek's perspective as commonplace because it was so at the LSE. W.H. Hutt, who had studied at the LSE, published "Co-ordination and the Size of the Firm" in the *South African Journal of Economics* in 1934. He extended the domain of coordination beyond the firm, suggesting, decades prior to Coase's famous 1960 paper, that, under certain conditions, the coordination of factors would be the same regardless of whether the concatenation were planned by a single entrepreneurial authority or among a number of separate entrepreneurs (Hutt, 1934, pp. 396–397). Likewise, Coase's mentor Arnold Plant in "Centralise or Decentralise?" published in 1937, also extended coordination beyond the firm, speaking, for example, of firms submitting "to the co-ordination imposed upon their activities by the price mechanism of the market" (Plant, 1937).

One might take the two levels to correspond to "unplanned" and "planned," but a society's economic system is subject to degrees of direction, control, and planning, so an extensive economic system is not necessarily simply "unplanned." Moreover, firms might vary in their degree of central direction, so the concatenate coordination within a firm is not necessarily simply "planned." Both at the level of firm and at the level of the polity, we may think of there being a *degree* of planning, direction, or guidance of subordinate actors by superior actors who are supposed to imagine, "see," or at least concern themselves with the referent concatenation.

The two sources of coordination of the polity-wide concatenation, free enterprise and conscious direction, were central to some of the most important debates in economics. The idea of central planning was to supersede liberal processes, instead making the economy essentially "one big factory" (Marx's phrase⁹), where managers make the production decisions, albeit in some schemes with surrogate pricing and feedback. The other major debate was whether the economy was self-coordinating, a debate brought forth particularly by the Great Depression and John Maynard Keynes.

5. Mutual coordination emerges and becomes focal

Coordination meant concatenate coordination. But things started to change with Thomas Schelling, who developed what we term "mutual coordination," an idea that seems to have had little place prior in game theory.¹⁰

Schelling's *The Strategy of Conflict* (1960) developed and eventually established a meaning of *coordination*. He gives the example of a man and wife separated in a department store:

What is necessary is to coordinate predictions, to read the same message in the common situation, to identify the one course of action that their expectations of each other can converge on. They must '*mutually recognize*' some unique signal that coordinates their expectations of each other. (Italics added)

He adds:

People *can* often concert their intentions or expectations with others if each knows that the other is trying to do the same. Most situations – perhaps every situation for people who are practiced at this kind of game – provide some clue for coordinating behavior, some focal point for each person's expectation of what the other expects him to expect to be expected to do. (Schelling, 1960, p. 57)

Here coordination is understood as something we hope to achieve in our interaction with others. It is manifest in that the individuals are aware of the challenge and results.

Schelling also discusses situations with divergent interests:

If we ask what determines the outcome in these cases, the answer again is in the coordination problem. Each of these problems requires coordination for a common gain, even though there is rivalry among alternative lines of common action. But, among the various choices, there is usually one or only a few that can serve as coordinator. (Schelling, 1960, p. 65)

So even if interests diverge, as in Fig. 3, there are only certain strategy combinations where actions are mutually coordinated.

Schelling argues that coordination is also important in bargaining: "The fundamental problem in tacit bargaining is that of *coordination*; we should inquire, then, what has to be coordinated in explicit bargaining. The answer may be that explicit bargaining requires, for an ultimate agreement, some coordination of the participants' expectations" (1960, pp. 69–70). Schelling

⁹ Marx (1936, p. 391).

¹⁰ We inspected Von Neumann and Morgenstern (1953) and Luce and Raiffa (1957). Neither indexes *coordination*. A Google book search establishes that Luce and Raiffa use "coordinate" only incidentally, in the mutual sense, on but a single page (177). For Von Neumann and Morgenstern, the search gave only restricted results, but it appears that the book does not use "coordinate" (though both books use "coordinate" mathematically, as in the coordinates of a point in a graph).

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1		0
0	0	1
0	0	2

Fig. 3. Mutual coordination: a coordination problem with partly conflicting interests.

proposes that expectations may be brought into convergence with the help of a focal point (pp. 71–72). What is required is a kind of mutual agreement. “The coordination game probably lies behind the stability of institutions and traditions [or conventions]” (1960, p. 91). Schelling is acknowledging that this form of coordination is central to conventions. Subsequently, David K. Lewis, who studied with Schelling, developed the idea of coordination equilibrium, common knowledge, and convention, in *Convention: A Philosophical Study* (1969). The coordination concepts were developed by Schelling’s *Micromotives and Macrobehavior* (1978), Ullmann-Margalit (1977), Sugden (1986), Young (1996), Chwe (2001), and other works. All this was rooted in mutual coordination, and mostly ignored concatenate coordination. In this literature, *coordination* meant mutual coordination.¹¹

Schelling, Lewis, and others provided canonical formulation of (mutual) coordination, and proof of relevance. Game theory got legs in the 1970s and took off in the 1980s. With the rise of game theory, the word *coordination* was increasingly understood to mean mutual coordination. The older understanding of the term (concatenate coordination) was increasingly eclipsed. Economists spoke instead of “social welfare,” the “social welfare function,” “optimality,” or “efficiency.” Economists now consumed Schelling, “battle of the sexes,” “cheap talk,” and path dependence, all mutual.

Was Schelling’s refocusing of *coordination* on “mutual” an irresponsible straying from well-established economic usage? Not at all. He simply pursued a meaning well established in the wider civilization, including the dictionary. That the economic literature so predominately used *coordination* in the concatenate sense, and that he didn’t let that stop him, is testimony to his respect for common language and common experience, as well as his intellectual independence.¹²

6. Mutual is now dominant

Since the 1980s and continuing today, the number of articles and books working in mutual coordination are simply innumerable.

The switch in emphasis from concatenate to mutual can be found in a variety of areas. In the work on path dependency *coordination* means mutual coordination: “lock-in” is about society coordinating on an inferior standard (Arthur, 1994). Building on Lewis, economists have refined the idea of convention, rooted in mutual coordination (Young, 1996). Many articles now address how governments of different nations or jurisdictions coordinate their policy decisions with one another.

In macroeconomics, where one would expect to find coordination meaning spontaneous concatenate coordination, we now find mutual coordination. New Keynesian macroeconomics in particular uses the coordination game to describe coordination failures in the macro economy (e.g., Diamond, 1982; Bryant, 1983; Cooper and John, 1988; Ball and Romer, 1991). In the past, a coordination failure would mean not reaching a pleasing outcome due to the failure of prices and institutions to promote beneficial production and exchange. Now coordination failure means coordinating on an inferior coordination equilibrium—such as a group of producers failing simultaneously to lower prices even though they would all be better off if they did all lower prices.

7. JSTOR searches of five major journals

At the outset of this paper we showed Fig. 1. We used JSTOR to search five lead journals: *Quarterly Journal of Economics* (begun 1886), *Economic Journal* (1891), *Journal of Political Economy* (1892), *American Economic Review* (1886/1908/1911, including precursor AEA publications), and *Economica* (1921).

In September 2007, we sampled articles beginning in 1886 because that was the first year of publication of the *QJE*. We wanted to search through 1960 when Schelling’s work emerged, and decided to break the period in two and used 1935 as a divider, yielding two pre-Schelling periods, 1886–1935 and 1936–1960. We searched on “coordination” or “co-ordination” in full-text, and limited the search to Articles. The items as listed in the Excel sheets are in the order displayed by JSTOR’s “Relevance” option for displaying search results—the top 50 for each period. We also sampled articles of 2001 and 2002, because those were the latest years for which the five journals all had material loaded in JSTOR, yielding 75 results. Thus,

¹¹ At the outset of *Micromotives and Macrobehavior* (pp. 20–23) Schelling discusses the extensive market process and uses the term *coordination* principally in the concatenate sense, and endorses the liberal order (p. 22). He does so, however, to make clear what he is not focusing on: “I am interested here in how much promise the economist’s result has outside of economics” (p. 23), which he associates with markets, and the remainder of the book focuses on issues of mutual coordination.

¹² Schelling’s independence extends also into game theory. From the start (1960, pp. 21, 65–118, 163–169, 226, 246–248, 284–303), Schelling has emphasized and been sensitive to the importance of asymmetric interpretation (though not using that term), a condition that must be ignored or suppressed to assume common knowledge (or symmetric interpretation), which is generally used to ensure closure in a game model.

the total raw sample represented in Fig. 1 is 175 articles. As shown in the Excel, each paper received a score of either 0 or 1 in the concatenate column, and either 0 or 1 in the mutual column—a small number of papers received a 1 in both columns. Many papers received a 1 in the ambiguous column, usually because the occurrence of “coordination” was brief and open to interpretation as either concatenate or mutual (as in our earlier example of the golf course owner and the golf school owner). Some papers were marked as not relevant, because “coordination” was used in an extraneous way, for example, only in the title of cited works. A skeptical reader can easily spot-check the Excel file. The bars in the figure are sized so as to represent a ratio of whichever type (concatenate or mutual) occurs most in the period.¹³ The results show a dramatic change. Future research could chart the transition from 1960 through 2000 and expand the sample to a wider array of journals and disciplines.

8. Economic science versus protreptic discourse

Concatenate came first. And it is perfectly correct and natural to the English language—it comes from the transitive meaning of the verb *to coordinate*, as in: the entrepreneur coordinates factors within his firm. Spontaneous concatenate coordination extends the idea beyond the eye of any actual coordinator.

There are inter-connections between concatenate and mutual. Focal points, mutual coordination, and emergent conventions suffuse economic processes. Without them it would not be possible to have the spontaneous order outcome that we observe. Nonetheless, placing too much emphasis on the mutual concepts (focal points, mutual coordination, and conventions) or confusing them with spontaneous order is harmful, because ultimately the conversation is about the big picture, the grand concatenation.

An appreciation of concatenate coordination informs the humanistic approach to political economy exemplified by Adam Smith. That approach sees that aesthetic sensibilities regarding morals and culture play a large role in the craftwork of economists, and moreover are themselves part of the economy, part of “well-being.” Smith wrote:

All constitutions of government, however, are valued only in proportion as they tend to promote the happiness of those who live under them. . . . From a certain spirit of system, however, from a certain love of art and contrivance, we sometimes seem to value the means more than the end, and to be eager to promote the happiness of our fellow-creatures, rather from a view to perfect and improve a certain beautiful and orderly system, than from any immediate sense or feeling of what they either suffer or enjoy. (Smith, 1790, p. 185)

Enlarging at several spots (pp. 165, 185–187, 316, 326), Smith suggested that “utility” or social happiness is an aestheticized notion. People of public spirit are moved by notions of social beauty.

Smith (1790) explained that beauty – and, we may add, individual happiness itself – is ineluctably “loose, vague, and indeterminate” (pp. 175, 327). Talk of coordination will often entail not only how best to please the mind imagined to behold the vast concatenation, but, to an inextinguishable degree, also an exploration of *what that mind’s aesthetic sensibilities are*. The “man of system” (p. 233) aesthetically delights in certain patterns impressed by the legislature, but Smith keeps us aesthetically alive to the fact that each individual has his own “principle of motion,” and that if individuality is terribly forsaken, “society must be at all times in the highest degree of disorder” (p. 234). Smith seeks a balance between individual liberty and contrary political institutions, a balance mediated by his own aesthetic sense of the social good.

“As Frank H. Knight has so often emphasized, problems of welfare economics must ultimately dissolve into a study of aesthetics and morals” (Coase, 1960, p. 154). That is why we should resist translating concatenate coordination as *efficiency*. Talk of efficiency suggests a definitive characterization of the maximand (or of the “output” or “social welfare”).

Concatenate coordination was done in, perhaps, by the desire to have an exact and separate science of economics. Many economists have tried to evade the loose, vague, and indeterminate part of the conversation by supplanting concatenate coordination by efficiency, optimality, and social-welfare function. Those concepts would enable economists to enclose economics within an exact grammar. The actual living guts of those concepts are sometimes treated as not their concern, other times as much more exact and definite than they really are.¹⁴ As Bauer (1981) put it: “[T]he use of mathematical methods has contributed more pervasively to inappropriate practices [including] the application of concepts which, even when they are capable of precise expression in the abstract, *are in practice necessarily vague*” (p. 265, italics added). The desire for an exact and separate science of economics, along with the advance of mutual coordination, has pushed out concatenate coordination, particularly of the great skein.

In *Adam Smith and the Virtues of Enlightenment*, Griswold (1999) writes that Smith’s “work evinces a sophisticated awareness of the problem of the relationship between form, content, and audience” (p. 41), and that his discourse “is intended to persuade us to view things in a certain light, to refine the ways in which we judge and feel, and perhaps to encourage us

¹³ The data are as follows: For the first period: 34 concatenate, 2 mutual, 12 ambiguous; for the second period: 36 concatenate, 1 mutual, 14 ambiguous; for 2001/2002: 6 concatenate, 40 mutual, 11 ambiguous.

¹⁴ Another group of economists desiring an exact and separate science of economics, the Austrians, particularly in the line of Israel Kirzner, have tried to fit claims about the coordinative properties of entrepreneurship and free markets to methodological ambitions of Ludwig von Mises for axioms, apodictic certainty, categorical deduction, and the like, and, we would argue, have illegitimately read Hayek into their group (e.g., notably Kirzner, 2000). See Klein and Briggeman (2009).

to act in a certain manner” (p. 49). Griswold thusly characterizes Smith’s discourse as *protreptic*—a term that refers back to Greek discourse that endeavored to persuade students, whose basic outlook and attitudes are still formative, to come to a favored way of viewing the whole matter, both “cause” and “effect” and their relations in one encompassing formulation, in preference to competing formulations, attitudes, and outlooks. Griswold views the “invisible hand” in just this way:

Just as the ‘invisible hand of Jupiter’ was part of the vocabulary of ancient ‘superstition,’ the ‘invisible hand’ is part of Smith’s philosophical and protreptic rhetoric whose purpose is likewise to establish order persuasively. The many ‘teleological’ or even, on occasion, ‘religious’ statements in *The Theory of Moral Sentiments* must be understood in connection with this aestheticized speculative outlook. (Griswold, 1999, p. 333)

We would suggest that the economics literature that had used “coordination” in discussing the vast concatenation had a similar protreptic quality, in that it addressed the aesthetic sensibilities that ponder the vast concatenation. The protreptic quality – addressed to edification of basic attitudes and outlooks – did not fit the “value-free” values of putatively scientific economics, and hence was discouraged and displaced by more formal discourse, as “efficiency” could be more neatly characterized within the narrow terms each article set for itself.

Concatenate coordination presumes particular ideological sensibilities no more than the idea of beauty in music presumes particular tastes in music. One may maintain that taxpayer subsidization of basic science improves concatenate coordination, etc. It would seem that concatenate coordination can accommodate concerns about public goods, externalities, and natural monopolies, and perhaps also, distribution, addictive behavior, ways of life, identity, and the public culture.¹⁵ Nothing about the idea of concatenate coordination denies that government intervention can improve the concatenation. In discussing the grand concatenation, the conversation is an exploration and negotiation of sensibilities about the good society and its policies.

Coordination, in the concatenate sense, especially as applied to the great skein, may not be the all-encompassing term for bottomless goodness. Perhaps it represents a part or aspect of that wellspring. But it lies in an aesthetic realm—loose, vague, and indeterminate.

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Appendix A. Cooperation in terms of the two coordinations

Members of a soccer team cooperate in securing victory. Neighbors cooperate in keeping the neighborhood clean. Factory workers cooperate in producing bread—assuming, that is, that they do cooperate!

Cooperation can be defined as the mutual coordinating of each’s actions in a context in which each cooperator perceives, however fuzzily, to be making a contribution *to the same referent concatenation*—a soccer victory, a clean neighborhood, a cooperative bread factory. There is a mutual awareness of cooperating in the achieving of the concatenation. The *spirit* of cooperation is especially pronounced when there is not only mutual awareness but mutual sentiment. “We did it together!”

Hayek (1988) wrote: “Cooperation, like solidarity, presupposes a large measure of agreement on ends as well as on methods employed in their pursuit. It makes sense in a small group whose members share particular habits, knowledge and beliefs about possibilities” (p. 19). There is a sense of common knowledge.

Some have depicted the free economy as a system of cooperation. Properly speaking, however, we should resist calling the Smith–Hayek spontaneous order a system of cooperation. True, it entails *myriad instances* of cooperation. But it also entails *myriad instances* of competition. It entails *myriad instances* of rather impersonal exchange, which, as cooperative moments, usually are only tiny and often ambivalent. It also entails *myriad instances* of deception and misrepresentation. It entails a lot of things, not just instances of cooperation.

Smith (1776, pp. 23, 26) said the day laborer obtains his woolen coat by virtue of “the assistance and co-operation of many thousands,” an expansive notion of cooperation reiterated by Hodgskin (1827, p. 25), but when Smith observes that man “stands at all times in need of the co-operation and assistance of great multitudes,” he says, “while his whole life is scarce sufficient to gain the friendship of a few persons,” suggesting that it is not simply cooperation that yields him the woolen coat.

Edward Gibbon Wakefield distinguished between “simple co-operation,” concordant with the usage we favor, and “complex co-operation,” essentially, a system of spontaneous concatenate coordination.¹⁶ John Stuart Mill ([1871], 118f) followed and elaborated Wakefield’s distinction.

¹⁵ Consider the following quotation from Friday (1922, p. 17): “we [must] scrutinize with the greatest care the assumption so complacently made by many economists that a set of market prices which brings about a proper coordination of the factors of production *effects an ideal distribution of product*” (italics added). Friday speaks of “a proper coordination” of factors on the basis of a mind of one type (interested in narrower productive efficiencies) imagined to behold the concatenation of production. But, we wonder, could he not then also speak of another mind beholding a larger or fuller concatenation of human experience, and say that that concatenation is *wanting in coordination* because of its distributional aspects?

¹⁶ Wakefield is quoted at length by Mill (1871/1909, pp. 116–118). The citation given is “Wakefield’s edition of Adam Smith, vol. I, p. 26”.

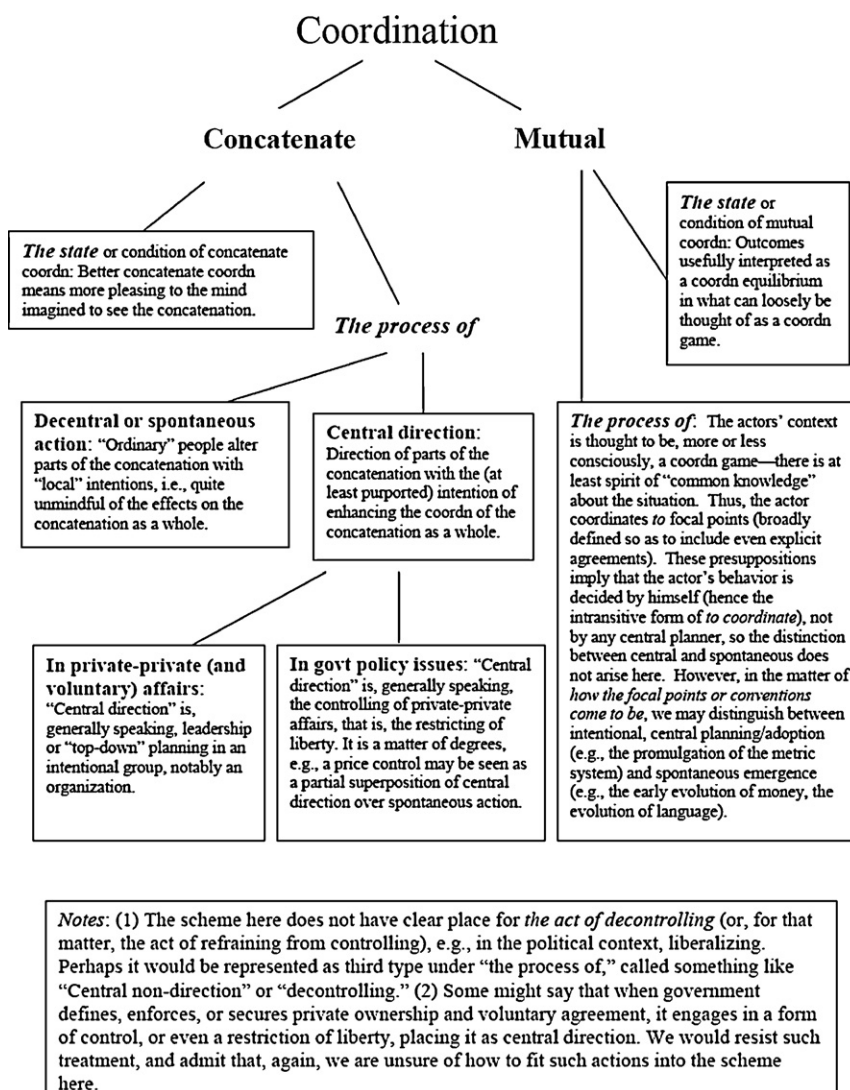


Fig. 4. Semantic diagram of coordination.

Frédéric Bastiat exemplified the tendency to depict the free market system as a system of harmony and cooperation. In *Economic Harmonies*, he used “co-operation” recklessly, and celebrated the market system as “a marvelous association” (Bastiat, 1996 [1850], p. 68). Another free-trade champion Henry George writes similarly: “But where the natural rights of all are secured, then competition. . . becomes the most simple, most extensive, most elastic, and most refined system of co-operation” (George [1886], p. 307). Philip Wicksteed (1967) likewise spoke of “a vast system of co-operation” and “one huge mutual benefit society” (p. 183). Milton and Rose Friedman (1980) take similar poetic license: “Cooperation is worldwide, just as in the economic system” (p. 17).

At a different ideological pole, Karl Marx rightly emphasized that the capitalist system, *in the whole*, was not cooperation—and ultimately condemned it for that. “[A]ll labour in which many individuals cooperate necessarily requires a commanding will to coordinate and unify the process. . . much as that of an orchestra conductor” (Marx, 1998, p. 382). As a matter of ethics and human fulfillment, Marx wanted the vast social concatenation to be a universal experience in mutual coordination—that is, he wanted everyone in society to be, in awareness and sentiments, mutually coordinated to the idea of the great concatenation as a cooperative project.¹⁷

But Marx’s vision forsakes the crucial liberal principles of achieving extended, complex, well coordinated concatenations. As Hayek (1988) put it, “The ‘moral equivalent of war’ offered to evoke solidarity is but a relapse into cruder principles of coordination” (p. 20).

¹⁷ On Marx, see Tucker (1961, pp. 188–223 and Klein (2005, pp. 13–14).

Appendix B. Central direction versus decentral/spontaneous action

Each kind of coordination invites the distinction between “centrally directed” and “spontaneous”¹⁸:

- *Spontaneous concatenate coordination*: ordinary people alter parts of the concatenation with only local intentions, that is, quite un mindful of the effects on the concatenation as a whole. As Smith said, the vast concatenation that produces a woolen coat was planned by no single mind. Hayek called the process “spontaneous order.”
- *Spontaneous emergence of convention*: as explained by Menger (1985 [1883]), Schelling (1960, 1978), Sugden (1989), David (1988), Arthur (1994), and others, mutual coordination sometimes proceeds without central direction or leadership, and, more importantly, *learned regularities* in behavior sometimes emerge without having been anyone’s intention, constituting *conventions* (Lewis, 1969), such as languages, monies, norms, or technological standards.

Fig. 4 diagrams and elaborates several distinctions. In addition to the primary distinction between concatenate and mutual, it distinguishes *the state or condition* and *the process of*. For concatenate coordination, it further distinguishes central direction and decentralized/spontaneous action (and it remarks on the parallel in how focal points or conventions come to be).

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¹⁸ Barry (1982) discusses these intellectual traditions and nicely distinguishes between the spontaneous coordination of the larger concatenation and the spontaneous emergence of institutions.

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