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Introduction to Game Theory and the Economics of On-Premise Sign Regulation

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Introduction to Game Theory and On-Premise Sign Regulation

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This paper is intended to serve as a companion piece to the new USSC publication *The Economics of On-Premise Signs* by David McAdams, Professor of Economics, Duke University (2015), and to serve as a primer for the layperson in regard to basic Game Theory concepts and on-premise signs, which Professor McAdams references and discusses throughout his report. The United States Sign Council Foundation asked Professor McAdams to look at the possible relationship between on-premise sign regulation and Game Theory in order to gain new insights into ways that more appropriate and adequate on-premise signs can be permitted, from a regulatory standpoint.

Sign owners and sign companies often have a difficult time understanding how towns regulate on-premise signs. To be more specific, sign owners and sign companies don't understand *why* towns regulate signs in the manner that they do. Sign regulations often appear to be: restrictive, burdensome to profitable activity, arbitrary, counter-intuitive, one-sided, vague, open to interpretation, and not uniform from jurisdiction to jurisdiction. A typical "sign regulator", as described in this introductory paper, could be: a member of a zoning or planning board, a municipal planner, a code enforcement officer, a member of a sign code revision committee, a member of a town board of supervisors or town council, or an advocate of increased laws pertaining to on-premise signs.

The purpose of this introduction, and of Professor McAdams' report, is to give those involved with on-premise signs a better understanding of the thought processes of local towns and sign regulators. It is possible that towns and sign regulators may be making mistakes in their regulation of on-premise signs, based on certain persistent false assumptions that form the basis for many sign code regulations. A side benefit of this new report may be that some in the planning community will also gain insights into their own attitudes and behaviors, even subconscious beliefs, so that false assumptions will not continue to affect the regulation of on-premise signs, and more rational and reasonable sign regulations can be achieved, that work for all concerned.

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Why Game Theory? Why now? How does this help sign owners and sign companies tackle the very difficult challenges that they have in gaining approvals for on-premise signs in many communities?

To answer these questions, let us consider a few additional questions: Why is it, when the value of an adequately-sized sign to a business or an office is demonstrated to a local sign code revision committee, this information often falls on deaf ears? Why is this information ignored, by and large, even when a very clear case can be made for an adequate sign being a boon to a wide variety of uses and enterprises, from banks to professional offices to retail/commercial to non-profit organizations?

It's because regulators are viewing these requests under a different paradigm – a different set of principles – a paradigm that can be expressed in Game Theory nomenclature, so that it can be better understood.

1. Local Sign Regulation

It is an established and accepted constitutional principle that towns (the term "towns" will be used in this introduction to refer to any town, borough, city, township or county) can implement content-neutral time, place and manner regulations of on-premise signs. These regulations typically involve rules on sign location, dimensions, mounting and so forth.

Much of what towns do to legitimately regulate on-premise signs fits within a town's "protective" role pursuant to content-neutral time, place and manner regulations: to prevent signs from being installed in an unsafe manner, to prevent signs from mimicking traffic control devices, to prevent signs from being installed too close to the roadway (where they could block the view of traffic and regulatory signs and/or confuse drivers), to prevent signs from hanging over the roadway or sidewalk, to prevent signs from blocking a motorist's view.

However, some sign regulations prevent the installation of "adequate" signs (signs that are adequate from the perspective of traffic safety and/or signs that are adequate for the typical sign owner), or other times sign regulations severely limit the number of signs that can be displayed and the specific type of signs that can be displayed. Towns sometimes suggest that they are dealing with the "negative effects" that signs can create. More on that particular issue below.

It is in these areas where sign owners and sign companies fail to grasp how local regulators think about sign regulation. This is where a lack of understanding exists, and Game Theory can help.

2. What is Game Theory?

Theory of Games and Economic Behavior, by John von Neumann and Oskar Morgenstern, Princeton University Press (1944), is often described as the groundbreaking work upon which modern-day game theory is based**.** Game theory combines the science of strategy, economics and behavior within thought problems that have multiple outcomes, depending on the decisions made by the participants in the problem. It has been used by the military, psychologists, business, sociologists, and other professions to help model and predict the behavior of various actors and/or stakeholders in any given situation. As such, it can easily be applied to sign zoning and the "science" of sign regulation. In Professor McAdams' report, you will see references to game theory, and a subset of game theory called "the prisoner's dilemma", which is a logical construct that breaks the behavior of two opposing actors down into discrete options, one vs the other, to explain the end result of the actions of each.

Game theory can help explain the decisions that businesses make in relation to their customers, the decisions that elected officials make in relation to their constituents, and indeed the decisions that sign regulators make in relation to their perceptions of consumers**,** sign owners and sign companies.

Game theory attempts to mathematically and logically determine the actions that any given actor would take to secure the <u>best outcome</u> for him-or-her-self in a wide array of scenarios. The common thread of these games is that all share a common feature of interdependence. That is, the outcome for each participant depends on the choices (strategies) of all. In so-called zero-sum games the interests of the players conflict totally, so that one person's gain always is another's loss. More typical are games that have the potential for either mutual gain (positive sum) or mutual harm (negative sum), as well as some conflict.

3. What is the Prisoner's Dilemma?

The "Prisoner's Dilemma" is an extremely popular logic game that shows why two completely "rational" individuals might not cooperate, even if it appears that it is in their best interests to do so. Professor McAdams describes the Prisoners Dilemma in his report. The Prisoner's Dilemma has been applied and analyzed in relation to a myriad of human endeavors: warfare, auctions, bargaining, mergers & acquisitions, oligopolies, social network formation, voting systems, industrial organization, and politics, just to name a few. Origination of the Prisoner's Dilemma game structure is generally attributed to Merrill Flood and Melvin Dresher, who worked at Project

RAND/RAND Corporation in 1950, and Albert W. Tucker, who refined the game with prison sentence rewards and named it the "prisoner's dilemma".

In his doctoral thesis *Non-Cooperative Games* (1950), John F. Nash (see the film *A Beautiful Mind,* 2001) introduced the concept of non-cooperative games, which contrasted to some degree with Von Neumann and Morgenstern's "cooperative" game framework. This was termed the "Nash equilibrium", which helped account for non-cooperative games involving two or more players, in which each player was assumed to know the equilibrium strategies of the other players, and no player had anything to gain by changing only their own strategy.

A Prisoner's Dilemma framework is often used by regulators, zoning board members and certain members of the public to describe why they believe signs should be legislated in the way that they are, and how sign owners and motorists behave in the real world. This application is done both consciously, and to a surprising extent, subconsciously.

4. On-Premise sign regulation as expressed in a Prisoner's Dilemma framework

Below will be an illustration of the Prisoner's Dilemma in regard to on-premise sign regulation and economics, based on the following set of facts.

Assume the following: there are two businesses located on a (4) four lane signalized commercially-zoned roadway that has a posted speed of 40 MPH – they are known as Business A and Business B. The roadway is located in Smithtown USA, which recently amended its sign code, and reduced the sign area permitted for freestanding signs to 30 square feet per side, regardless of the size of the property or frontage width.

According to the USSC *Best Practices Standards for On-Premise Signs* (2015) as well as the latest edition of the American Planning Association's *Street Graphics and the Law* (2015), the recommended sign area for a freestanding sign along this particular roadway should be larger, from the perspective of the needs of motorist, sign legibility, and traffic safety.

Business A is a bank; Business B is a sit-down restaurant with take-out available. The bank has sixteen (16) letters in its trademarked name: Best National Bank. Based on

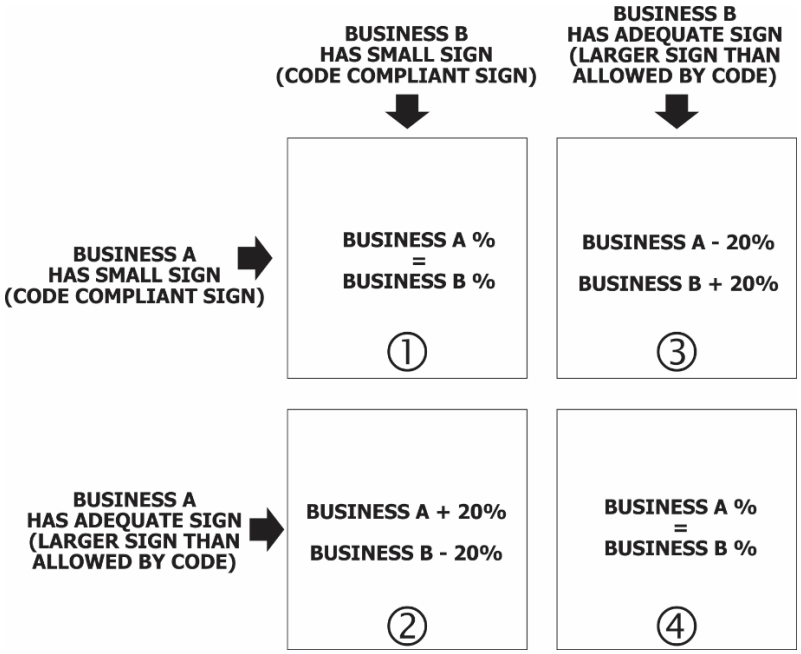
the research, recommended freestanding sign size is 54 square feet, not 30 square feet, or 80% larger than what is permitted by Code. Please see either publication referenced above for the calculation formula.

Nonetheless, the town changed its code.

At this point in our Prisoner's Dilemma scenario, it's important to note that……. Smithtown has historically assumed that businesses along a roadway are "in competition" with one another (see the Greenway document referenced in Professor McAdams' paper). This is a false assumption, according to Professor McAdams. A typical suburban (or urban) corridor in a commercial district has businesses that are *not* in competition with one another. A typical roadway may have a gas station at the corner, then a pharmacy/drugstore, a restaurant, a pet shop, a bank, maybe another restaurant, a furniture store, a tire or quick lube place and so forth. Smithtown's assumption that adjacent businesses are in competition is a false assumption. Business A and Business B are clearly not competitors. See below for more on false assumptions underlying sign zoning.

In addition, Smithtown has historically assumed that motorists traveling along the roadway are in a captive shopping environment. That is, the motorist/consumers are captive, they are a finite resource that all the properties along our roadway must fiercely compete for. This is another false assumption that will be discussed later, and in Professor McAdams' report.

The local zoning board in Smithtown has never issued a sign variance for larger freestanding sign area, based upon the following Prisoner's Dilemma scenario (please see next page):



As you can see, there are (4) four different outcomes or permutations in this Smithtown Game Theory grid based on the Prisoner's Dilemma:

#1 Both businesses have code-compliant (small) signs

#2 Business A has an adequate sign, which is a sign that is larger than allowed by code, while Business B has a code-compliant (small) sign

#3 Business B has an adequate sign, which is a sign that is larger than allowed by code, while Business A has a code-compliant (small) sign

#4 Both businesses have adequate signs, which are signs that are larger than permitted by code

This example of a Prisoner's Dilemma grid shows how a "sign regulator's" mind might initially frame the question of whether larger signs should be permitted within Smithtown. This grid looks at the specific social and economic behavior of the parties involved (Business A and Business B) on a "micro" level. Then the regulator's mind extrapolates the outcomes on a "macro" level, and applies the Prisoner's Dilemma grid to all behavior and outcomes related to on-premise signs.

At baseline conditions (everyone has a Code-compliant small sign, a less than adequate sign), Business A (the bank) does X amount of business and Business B does Y amount of business; it

may be equal in terms of dollars or not; but that is the baseline amount of revenue or sales that each entity enjoys (expressed as % = %); the status quo if you will.

If Business A (the bank) gets approval to install an “adequate” sign, Business A’s revenue will go up by 20%, but at the expense of Business B, who still only has a small code-compliant sign. And vice-versa.

When both Business A and Business B get approval for a larger “adequate” sign, conditions return to the baseline in the sign regulator’s mind; the signs cancel each other out; neither business does any more or any less business, because, the assumption is, there is only a fixed quantity of business to go around (the motorists represent a captive audience). One businesses’ gain is another businesses’ loss, under this approach.

So the size of the sign, all things being equal (if all signs are equal) has no impact on site performance.

And the sign regulators on the zoning board in Smithtown reason further: since all of the above is true, it does not matter if the signs are smaller and code compliant – because no more or less business will be conducted by Business A or Business B. In addition, some constituents in Smithtown don’t like large signs for aesthetic reasons, and if Smithtown is going to have ugly on-premise signs, then at least they will be *small* ugly signs, and not large (or adequate) ugly on-premise signs; so the thinking goes. It’s a tight, but flawed, logical box.

5. False assumptions contained in the regulator’s Prisoner’s Dilemma paradigm

A. Smithtown has falsely assumed that Business A and Business B are in competition; see above and in Professor McAdams’ report. To the contrary, these businesses are not in competition. So they are not competing wildly for attention vs. their adjacent neighbors. As to whether separate individual businesses that are not in competition with one another compete for *attention* any way, Professor McAdams also touches on this subject.

B. Motorists in Smithtown along this roadway are not in a captive retail environment. Again, see Professor McAdams report; this is a false assumption made by many regulators.

C. An additional false assumption made by Smithtown and many regulators: having an adequate sign has no impact on the potential for true business growth, and does not generate any additional sales, beyond the baseline, for either Business A or Business B**.**

This is incorrect. An adequate sign can spur additional sales and transactions that were not contemplated by the motorist/consumer, above and beyond any baseline, and does not harm the surrounding businesses or detract from the economic performance of surrounding businesses. If not for the better identification (that is, adequate identification), motorists might not recognize a business or stop for that cup of coffee in the morning or try the restaurant's take-out after visiting the bank or make an additional purchase that was not intended when the motorist set out on his or her trip.

And this additional economic activity does not harm the adjacent businesses, because <u>they are not in competition</u>. To prohibit or over-regulate signs so that businesses cannot have adequate signage is counter-productive for all concerned. And larger signs cause no harm to adjacent business nor the public (it's actually a public benefit in terms of traffic safety).

D. Finally, research performed by both the USSC and others has consistently demonstrated that on-premise signs, even on-premise signs with a digital sign component, do not cause traffic accidents or so much "driver distraction" that motorists perform inappropriate driving maneuvers and have accidents.

Yet, regulators will suggest that strict on-premise sign regulations are necessary to protect the public, to avoid distraction and to avoid accidents. This position has, thus far, not been supported by research, whether it be in post-accident studies or in roadway analysis studies correlating accidents and sign locations or in comprehensive naturalistic studies. It is reasonable to assume, at some point, from an objective standpoint, that research or evidence should exist that to support this assumption; otherwise it becomes a false assumption.

This then is the final false assumption that towns and regulators often operate under: the need to over-regulate signs to prevent distraction and/or protect drivers and traffic safety**,** because on-premise signs can be dangerous.

In fact, research supports the conclusion that the number of signs along a roadway, or the presence of "large" signs along a roadway, or the amount of information presented on any given on-premise sign along a roadway does not cause traffic accidents or so much so-called driver distraction that a motorist's ability to safety operate his or her motor vehicle is impaired.

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