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THE NUMERICAL PSYCHOLOGY OF PERFORMANCE INFORMATION

– Implications for Citizens, Managers, and Policy Makers

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ABSTRACT: *Performance information attaches numbers to the inputs, outputs, and outcomes of public services. Numbers are what separate performance information from other sources of information about public sector performance. In cognitive and social psychology, there are vast amounts of research on the profound effects of numbers on human attitudes and behavior. However, these insights are largely unexplored by scholars of performance information. The article introduces the importance of numerical psychology for the study of performance information. It is pointed out how numerical research both challenges existing beliefs about performance information and allows for the formulation of new hypotheses. These insights are relevant to all levels of study, including citizens, managers, and policy makers.*

KEYWORDS: *performance measures, psychology, heuristics and biases*

Every day, from the morning paper to the evening news, Americans are served a steady diet of statistics. We are given the latest figures from consumer prices and the unemployment rate, lagging and leading economic indicators, reading scores, and life expectancies, not to mention data on crime, divorce, and the money supply.

Alonso and Starr (1987, p. 1)

Herbert Simon was keen to stress the numerical aspect of performance information and the implications for decisions and attitudes at the administrative level (Simon, 1937; 1939) and in the broader public (Simon & Ridley, 1938). Today, most definitions of performance information stress the quantitative aspect of measuring performance (Bouckaert & Hilligan, 2006; Davies, 1999; Hood, 2007; James, 2011b; Moynihan, 2008; Perrin, 1998; Thomas, 2006; Van Dooren, Bouckaert, & Halligan, 2010). Drawing on this literature, we can broadly define performance information as any regular, systematic, and quantitative data that capture the inputs, actions, outputs, or outcomes of public organizations. This numerical aspect is also what ties modern-day performance measures together with the broader development of the modern state (Williams, 2003). As Eberstadt (1995, p. 2) has outlined: “What makes a state modern, in an important sense, is its intention to use numbers as a basis for its actions. The modern state is an edifice built on numbers.” This article takes the numerical aspect of performance information as its point of departure. It is the *numerical* aspect that *fundamentally* sets it apart from other informal sources of information about public services. However, while the central role of numbers in performance information is evident, performance measurement research tends to treat the numerical aspect as a *black box*: We do not put the numbers *themselves* under scrutiny when we set out to understand the use and

effects of performance information on policy makers, managers, or citizens. This article argues that the study of performance information will benefit greatly from opening this black box: How are numbers about performance different from other forms of non-numerical feedback? And how do managers, policy makers, and citizens make sense of various forms of numerical performance information?

We can approach these questions by drawing on the vast experimental research in cognitive and social psychology on how human decision making and attitude formation are formed by numbers. As pointed out by James and John (2007, p. 568): “The connection between public management and political behavior has been largely neglected because the literatures have mostly been developed as separate areas of endeavor.” By stressing the psychological aspects of performance information *as numbers*, the efforts presented here are an example of a broader research agenda basing the study of performance information on how human information processing affects attitudes and decision making (Baumgartner & Jones, 2005; James, 2011b). This agenda is in line with the goal already outlined by Simon (1955, p. 100) to place a “marking stone” between psychology and public administration in order to bring the two fields closer together (Olsen, 2015b).

Methodologically, we already see a closer integration of public administration and psychology. Recent experimental research efforts into the effects of performance information are a good example of this (James, 2011a; 2011b; James & Mosely, 2014; Olsen, 2013b; 2015b; Van Ryzin & Lavena, 2013; Van Ryzin, 2013). However, as this article will argue, a tighter theoretical integration of the two is also needed – and the study of the effects of performance information is a core example of the potential for fruitful integration of psychology and public administration. A view of performance information as first and foremost *numerical* information opens up at least two broad lines of research:

The first one asks the fundamental question of how numerical quantitative information about public performance affects attitudes and behaviors *differently* from non-numerical and more informal sources of information. The psychology of numbers poses some fundamental questions of about the different impact of performance information and non-routine feedback. The second line of inquiry focuses on how humans make sense of various numerical information. In particular, four aspects will be stressed: (1) human attention to symbolic round numbers and the leftmost-digit bias, (2) numerical equivalence framing, (3) numerical precision and confidence, and (4) comparison of numbers in space and time. These topics indicate the broad and multifaceted perspective on performance information stemming from a perspective informed by the psychology of numbers. The remainder of the article will be organized according to these two themes. They both have relevance for our understanding of performance information at the level of managers, policy makers, and citizens. In the discussion, I will turn to the question of individual differences that may alter or moderate the role of numbers in an administrative setting.

Numbers or Cases of Performance: Abstract vs. Concrete Information

The first important direction of research is to understand how numerical performance information affects citizens and managers compared with other non-numerical, informal sources of information. The latter are the non-routine sources of feedback ranging from personal experience with public services to media coverage of instances and cases (Kroll, 2013). The performance literature has generally stressed the potency of quantitative information as an important aspect of performance information. For both good and bad, this potency is captured by the notion that “what gets measured gets done” (Osborne & Gaebler, 1992, p. 146). Suddenly, a number, score, rank, or tier can be associated with an organization’s performance, and this feedback exerts influence on organizations, managers,

and citizens. From the perspective of unintended consequences of performance information, we have various accounts of the potency of performance information. For instance, the notion of *tunnel vision* highlights that quantified phenomena attract management attention “at the expense of unquantified aspects of performance” (Smith, 1995, p. 284). From a more positive view of performance information, we find a similar belief in the potency of performance information. Holzer and Yang (2004, p. 16) have argued that performance information can crowd out vague and subjective ideas about performance in the public sector: “Measurement helps to move the basis of decision-making from personal experience to proof of measurable accomplishment or lack thereof.” Others stress the simplification of quantitative information relative to other types of information as a source of its ability to influence (Herbst, 1993). Espeland and Sauder (2007, p. 17) stress how numerical “information appears more robust and definitive than it would if presented in more complicated forms.” Simplification of information is seen as absorbing the uncertainties, assumptions, and contingencies of the underlying data (March & Simon, 1958; Stone, 1997; Moynihan, 2008). We also find the notion that performance information is potent because numbers seem more “sincere.” Performance information tends to seem more authoritative than other sources of information. For instance, it has been argued that performance numbers can be used to impress and convince politicians in budgetary negotiations (Wildavsky, 1964, p. 95). In summary, there is an underlying idea that performance information has the potential ability to *crowd out* less formal channels of information about performance, for better or worse.

However, drawing on social and cognitive psychology, we find various well-established findings that fundamentally challenge the relative potency of numbers compared with other types of information. Generally, scholars of performance information have overlooked the potency of exemplification and concreteness in attitude formation and decision making among both citizens and professionals. We can recognize this from our own

lives: Single events, anecdotes, or examples tend to stick out while abstract or general insights, such as statistics, tend to move to the backstage of our memories. This fundamental insight is at odds with the potency of performance information relative to other non-routine sources of information. Both citizens and policy makers have other more informal and non-numerical sources of information at their disposal. As James (2011b, p. 402) has noted: “Citizens may not have much of an idea about the overall performance of a local public body only interacting with it on a case-by-case basis for a subset of services.” Similarly, at the level of managers and policy makers, we can expect numerical performance information to be accompanied by “nonroutine information...if something went wrong, customers complained, interest group called, other public entities sent letters, the media showed up” (Kroll, 2013, p. 265). These are the “slow drip of everyday life” (Baybeck & McClurg, 2005, p. 498), which, together with numerical performance information, feeds into our impression about the performance of a service or an organization.

Across disciplines we find rather compelling empirical and theoretical support for the importance of such sources of information relative to hard performance information. In psychology we find a long and strong tradition of comparing concrete and abstract information and how it affects human attitudes and decision making (Borgida & Nisbett, 1977; Pettus & Diener, 1977). These studies indicate that detailed and personal information affects judgment more than statistical and general information. Some refer to this as the vividness effect because attention is disproportionately drawn to concrete and vividly described pieces of information (Zillmann, 2006). Here we can view performance information as less concrete, as it is an abstract aggregation of information that cannot be otherwise seen in the real world by the observer (Moynihan, 2008, p. 102).

In media research, exemplification theory points to the profound use and effect of “vox pops” or “popular exemplars” in comparison with base-rate information. Base-rate

information provides quantifiable facts and figures much like those of performance information. The popular exemplar resembles a single case that may be representative of a larger group. Daschmann (2000) did an experiment comparing the strength of the two by offering people vox pop information and a public opinion poll. He found that “the influence of exemplars was considerably stronger, to the point of overriding the effects of poll results” (Daschmann, 2000, p. 160). These findings are echoed in framing studies in political psychology that compare the frame strength of episodic and thematic frames (Iyengar, 1990; Iyengar & Kinder, 2010). Episodic frames put a human face on political issues while thematic frames stress general trends and statistics. Episodic frames have been found to be more emotionally engaging and, in turn, more potent than thematic frames (Gross, 2008; Aarøe, 2011).

These examples leave us with a number of interesting questions for future research: Scholars of performance information need to empirically question our (assumed) beliefs about the potency of performance information. The vast amount of research on abstractness and concreteness of information requires us to take a step back and explore how performance information affects attitudes and behavior compared with other sources of information. Alternative sources of concrete information from news reports, word of mouth, or personal experience are still widely available to both managers and citizens. A key question for future research is: How potent is performance information relative to day-to-day case-based sources of information performance in the public sector? It also forces us to think more about the various emotions that performance information triggers: Can performance information be emotionally engaging to the same extent as a personal experience or exemplification of public sector performance? Finally, it draws our attention to whether political and administrative elites differ from citizens: Are managers and policy makers affected mainly by numerical information while citizens draw more on informal non-numerical performance

cues? The overreaching theme of these questions for future research is that while performance information is spreading across countries, sectors, and levels of government, we should not by default expect it to be the sole source of information about performance. Considering these questions will also help practitioners get a grip on the differences in the information that individuals inside and outside of the organization tend to draw inferences from.

Numerical Variations and Performance Information

In his seminal book *The Politics of the Budgetary Process*, Aron Wildavsky deals with the incomprehensible nature of *large numbers* in a political-administrative context. For instance, he proposes that most people would prefer to devote “quite a lot” of money to medical research sponsored by the federal government. However, the tricky question arises: “How much is that? A million, a hundred million, a billion?” (Wildavsky, 1964, p. 44). The second line of argument addressed here deals with how humans process numbers. The question is: How do we make sense of numbers, and what does this imply for the study of performance information? Here I will stress four dimensions of the research on numbers and how they relate to the study of performance information. These are (1) the importance of symbolic and round numbers, (2) the role of equivalence framing, (3) numerical precision and confidence, and (4) comparison of numbers in time and space.

Round numbers and symbolic numbers

The first line of research indicates that the finer details of numbers are often discarded when humans process them. The most pronounced example of this is our reliance on round numbers. Powers of 10 and multipliers of 10 and 5 are the numbers most frequently produced

by humans in everything from old written material to the World Wide Web (Dehaene & Mehler, 1992; Dehaene, 2011; Dorogovtsev et al., 2006). Round numbers constitute a type of cognitive reference point that we orient ourselves toward (Rosch, 1975). The importance of round numbers has also been shown in contexts that closely resemble performance information. For example, round numbers have been found to motivate us to enhance our performance in sports and education (Pope & Simonsohn, 2011). In a similar manner, we may expect managers or policy makers to enhance performance in order to achieve some symbolic (yet arbitrary) score on performance measures. Anecdotally, it is not difficult to think of an organization that has bragged about achieving some score (e.g., “We helped 1,000 satisfied citizens today!”) or one being named and shamed for some profound negative measure (e.g., “\$100 million deficit!”). It has also been found that round numbers in terms of categories of “top 10” or “top 20” have a major effect on consumer evaluation of rankings (Isaac & Schindler, 2014). In addition, public opinion on government spending depends less on the actual amount of spending and more on the extent to which spending exceeds certain round number thresholds (Malhotra & Margalit, 2010).

The latter case is an example of the leftmost-digit bias, which denotes that we tend to partially discard digits as we process numbers from left to right (Hinrichs, Berie, & Mosell 1982; Thomas & Morwitz, 2005). This implies an overreliance on the leftmost digit of multidigit numbers. The broader implication of this is a high degree of sensitivity to changes in the leftmost digit in our judgment about numbers. In fact, this line of research has recently been tested for public sector performance information. Olsen (2013b) found a leftmost-digit bias in an experiment among a representative sample of citizens where the participants were asked to evaluate schools according to their yearly grade average. The results showed that the second digit of the simple double-digit grade information was largely discarded in the

evaluations. Accordingly, grade of 6.0 and 6.9 were evaluated to be equally good. A school's evaluations changed discontinuously only as the leftmost digit changed, e.g. from 6.9 to 7.0.

How may future studies of performance information be informed by these insights? They challenge us to look for symbolic reference points in numbers that disproportionately affect managerial efforts and citizens' beliefs about performance (Olsen, 2013a). We may ask whether managers and public employees behave differently when measured performance is just below or above a symbolic round number. This question could help identify both motivational factors connected to numbers and also potential gaming behavior as a function of discontinuous stakes attached to numbers (Smith, 1995). More broadly, this line of research forces us to think more carefully about the unconscious effects that numbers might have on both citizens and managers independent of the underlying phenomenon they capture.

Numerical equivalence framing

A second line of research focuses on the implications of the results from equivalence framing experiments that show how respondents respond differently when assigned logically equivalent pieces of numerical information (Levin, Schneider, & Gaeth, 1998). The underlying explanation is that individuals encode information according to its descriptive valence, which in turn makes either positive or negative associations more accessible in memory. This implies that when we hear about “dissatisfaction”, “death rates”, or “unemployment”, negative associations move to the foreground, while performance in terms of “satisfaction”, “survival rates”, or “employment” leads to more positive associations. This process induces valence-consistent shifts in our evaluation of performance information—even if the underlying performance is the exact same. A recent illustration of this is an experimental study of the effects of presenting hospital satisfaction survey results to citizens as either “satisfaction rates” or “dissatisfaction rates” (Olsen, 2015a). Presenting results as a

10% dissatisfaction rate instead of a logically equivalent 90% satisfaction rate resulted in a drop of one standard deviation in citizens' average evaluation of hospital services.

The psychological studies of equivalence framing have implications for our assumptions about how fragile the effect of performance information is. We should take note of how seemingly similar ways of presenting performance information can have vastly different impacts. This raises an important question for future research and practitioners: How can we provide performance information to citizens in a way that makes them less susceptible to framing effects? Furthermore, in the world of performance information, managers and policy makers have some leverage in terms of how numbers are presented. This also raises an important question for future research about the framing of performance information and blame avoidance (Johnsen, 2012): To what extent do administrative and political elites actively frame performance in ways that might provide citizens with a more positive impression of performance?

Precision and confidence in numbers

Another highly relevant perspective is research on cues stemming from numerical precision. In the discussion on numbers versus anecdotes, we saw the sentiment reflected that numbers can seem more scientific and thoughtful (Herbst, 1993). However, among numbers there can also be various implicit cues that may strengthen our belief in them. Numerical *precision* is one such cue. Research in marketing and social psychology indicates that humans rely on numerical precision when forming decisions and attitudes based on numerical information. The central finding here is that our confidence in numbers is affected by their precision (Janiszewski & Uy, 2008). From the theory of conversational logic, we expect communicators to apply a level of precision that reflects the accuracy of their knowledge (Grice, 1975; Mason et al., 2013; Zhang & Schwarz, 2013). Accordingly, the level of

precision implicitly informs us about the level of accuracy of the knowledge underlying a measure. However, precision has no effect on our judgment if the communicator is viewed as untrustworthy, self-interested, or incompetent (Zhang & Schwarz, 2013).

The line of research on numerical precision offers some important questions to scholars of performance information. Recently, there has been a focus on how the source of performance information may affect its impact on citizens (Van Ryzin, 2007; Van Ryzin & Lavena, 2013). With the precision cue in mind, our attention must be extended to how aspects of the numbers *themselves* affect citizens' beliefs about them. Do citizens perceive precise performance information as confidence in performance measurement accuracy? It raises the question whether managers and policy makers use precision and round numbers strategically in order to make information look more scientific and accurate than what is actually warranted by the data. This may help explain why performance information in many instances has been presented with a level of detail that is unwarranted by the uncertainty of the data (Goldstein & Spiegelhalter, 1996; Bird et al., 2005; Jacobs, Goddard, & Smith, 2005). Here lies a task for future research to explore the potential motivations for variation in the precision of performance information that is published to the public. From practitioners' point of view, these insights stress the importance of paying careful attention to how the numerical precision of an organization's performance information carries implicit cues to the intended audience about organizational confidence in the measure's validity.

Comparison of numbers in space and time

A final line of inquiry stresses the importance of comparison between numbers. In isolation even the simplest indicators are difficult for citizens to judge without evoking a reference point (Mussweiler, 2003). Is a 5% unemployment rate high or low? Is a top-100 school doing well enough? Will I let myself undergo surgery at a hospital with a patient satisfaction rate of

95.7%? At face value, these may seem like simple questions, yet in providing an answer, we tend to draw on some point of reference: What is the unemployment rate in neighboring states? How well did the school do last year? What is the average satisfaction rate of similar hospitals? When confronted with performance data, we seek out sources for comparisons. Simon (1939, p. 106) was well aware of this process: “The only sound basis for decisions about numbers is numerical factual information about past experiences or the experiences of others nothing more nor less than comparative statistics.” This distinction between (historical) comparison in time and (social) comparison with others has long been established in social psychology (Albert, 1977; Festinger, 1954). Very recent research on performance information has also tried to understand how citizens attend to various benchmarks when making judgments about public services. One interesting finding here is that social reference points tend to affect attitudes about performance more than historical or absolute ones (Charbonneau & Van Ryzin, 2013; Olsen, 2013c; Hansen, Olsen, & Bech, 2014). That is, we care more about the performance of other states, municipalities, or organizations relative to our own jurisdiction than historical developments over the course of time.

The potential importance of reference points leaves us with a number of unanswered questions. A major task in the coming years is to identify the benchmarks that citizens and managers apply, consciously or unconsciously, when making decisions related to public services. In a real-world political-administrative setting, multiple potential reference points are available; which factors affect what type of reference points that are drawn on in such a complex setting? Research on citizens’ use of reference points may also inform practitioners about how to provide benchmarks that are intuitive and useful to citizens. However, as also noted for the other topics, it also raises the question of the extent to which policy makers strategically can manipulate the reference points that their organization is measured against.

Discussion: Implications and Cross-cutting Themes

In the above, I stressed five areas of research on the effects of performance information in which the vast existing body of research in cognitive and social psychology offers insights with high immediate relevance to our field. Here I will stress some cross-cutting implications for future research into the effects of performance information on both citizens and policy makers.

Future research in our field must to some extent be either informed by or consistent with the vast psychological research on how numerical information affects human decision making. There are no good reasons to reject the idea that fundamental psychological aspects of human number processing affect behavior and attitudes in administrative settings (Simon, 1955). While the themes discussed here might seem like a wide extension of current research efforts, they should rather be seen as attempt to narrow and sharpen our scope of investigation when studying performance information. We can ask better scientific questions about how performance information affects attitudes and behavior if our point of departure is the strong experimental findings obtained by cognitive and social psychology. From the above we now have an awareness of how symbolic numbers, performance measure valence, precision cues, or reference points can induce major shifts in how performance information is perceived. Considerations about such effects should feed into our own analysis of how performance information works in a particular context. We can use these insights to improve our hypotheses, inform our experimental designs, and resolve potential counterintuitive or less robust findings.

Another cross-cutting theme with implications for future research is the individual differences in the effects of numbers between citizens and policy makers. At first glance, the psychology of numbers challenges us to take a step back and look closer at the more fundamental aspects of human processing of performance information. It provides a set

of concepts and established facts about numerical cognition that span across different contexts and actors. However, psychology also provides us with alternative theories about when to expect that decision contexts and individual characteristics affect the use of numerical cues. One example of this is how differences in abilities to work with numbers affect how susceptible we are to numerical framing effects (Steen, 1997; Peters et al., 2006). Another example points to the importance of expertise and alternative sources of information as moderators of how individuals are affected by performance information (Olsen, 2015a). This also points to the more practical implications of integrating psychology into the study of performance information: It turns our focus to how different actors in the administrative setting are affected by numbers. This has the opportunity to inform our use of performance information in order to affect attitudes or behavior depending on the receiver's abilities or incentives. Here lies also an important contribution to psychology from scholars of performance information. Performance information allows for the study of numbers on many dimensions, from managers' use of numbers to how laymen make sense of them. It also spans many levels of analysis, from individuals over organizations to how sectors and societies are formed by numerical aspects of performance information. Performance information scholars therefore have a unique opportunity to "report back" to the broader psychological study of numbers. This allows us to understand the external validity of how hypotheses about numerical cognition, often devised in the lab, extend to important decisions about public services in the real world of administrative decision making.

A final direction for future research is the potential for gaming or strategic use of performance information, which has been noted across the various themes. Given what we outlined above, we see a greatly expanded number of ways in which measured organizations can affect external perception of their performance. Organizations can use numerical or nonnumerical performance information given the emotional response they intend to induce.

Organizations can change the valence of a performance measure or try to affect the reference points that those using the information draw on. And finally, organizations can choose to report certain symbolic or precise numbers in order to implicitly communicate achievements and downplay failures. Indeed, Moynihan (2008, p. 107) has noted how the numerical aspect of performance information can be used strategically as “actors seeking to maximize the impact of numbers will usually present them in a way that downplay rival interpretations.” With the psychology of numbers, we are handed some testable expectations about how organizations might choose to report their performance. This calls for future “forensic” studies on how performance information is reported given various incentives to present the data in certain ways.

Conclusion

Performance information is, at its core, an attempt to put numbers on the inputs, outputs, and outcomes of public services. It is the numerical aspect that fundamentally sets it apart from other informal sources of information about public services. This article has argued that this simple fact implies that scholars of performance information must engage with the long tradition in cognitive and social psychology of studying how numbers affect humans. Doing so provides us with a vast number of strong experimental results that are highly relevant to the study of performance information at all levels of government and across policy areas. Specifically, the article has stressed two central themes of research:

The first theme asks about the relative potency of performance information in terms of effects on attitudes and behavior relative to other nonnumerical and informal forms of information. Numerous studies across the fields of social and political psychology stress the relative strength of concrete, personalized types of information compared with abstract and general information like performance information. Scholars of performance information need

to do more empirical work on the different ways in which formal, numerical performance information affects attitudes and behavior compared with informal, case-based feedback about performance. What sets the effect of performance information apart from feedback obtained via day-by-day interactions? The second theme includes a vast literature on cognitive and social aspects of numbers and how these insights may inform our understanding of how managers and citizens make sense of performance information. In particular, four aspects were outlined, namely (1) human attention to round numbers and the leftmost-digit bias, (2) numerical equivalence framing, (3) numerical precision and confidence, and (4) comparison of numbers in space and time. Taken together, these aspects turn our attention to other possible effects of performance information that would otherwise have been ignored.

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