The Role of Precision in Spatial Narratives: Using a Modified Discourse Quality Index to Measure the Quality of Deliberative Spatial Data

by

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To the Milazzos

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List of Abbreviations

CAQDAS	Computer assisted qualitative data analysis software
CNF	Chugach National Forest
DQI	Discourse quality index
DTM	Deliberative Transformative Moments
GCS	Geographic coordinate system(s)
GIS	Geographic information system(s)
GIScience	Geographic information science
NCGIA	National Center for Geographic Information and Analysis
PDF	Portable Document Format
PGIS	Participatory geographic information system(s)
PPGIS	Public participation geographic information system(s)
PWS	Prince William Sound
softGIS	Soft geographic information system(s)
SPSS	Statistical Package for the Social Sciences
USFS	United States Forest Service
WSA	Wilderness Study Area
VGI	Volunteered geographic information

Abstract

The importance of spatial precision in geographic information science is not limited to quantitative data. As spatial data can also exist in qualitative form, this project showed how modifying a discourse quality index from the field of discourse ethics helped to better understand whether mentioning specific spatial locations changes the quality of spatial narratives. The discourse quality index was modified by incorporating an item into the index that detected the presence and magnitude of a spatial precision construct. The spatial narratives analyzed with this modified index were public comments submitted during a public policy revision process, for a national forest plan revision at the Chugach National Forest in Alaska, U.S.A. One hundred fifty-one public comments submitted during this policy process were analyzed.

Analysis showed when discourse quality values were classed by their magnitude of spatial precision, the discourse quality changed between comments with no spatial precision versus those considered to have spatial precision. The results suggest, preliminarily, that employing spatial precision in narratives changes discourse quality during deliberative activities. This project demonstrated how spatial precision applied to qualitative datasets. Further, the way in which people use spatial precision to communicate during a policy revision process can impact how spatial narratives are understood and valued. Most importantly, this project showed that including spatial thinking into our discourse shapes the way people communicate their landscape values, and that spatial thinking is indeed an influential communicative tool. The results leave room to explore the degree to which incorporating precise spatial thinking into their arguments for policies could empower individuals and/or political groups. Suggestions for further research are provided.

Chapter 1 Introduction

Spatial precision in geographic information science (GIScience) is not limited to quantitative spatial data. Spatial precision can be applied to qualitative datasets. Furthermore, spatial precision can be detected via narrative, and how people use spatial precision to communicate can impact how spatial narratives are understood and valued. Thus, this project suggested researching spatial precision in narratives can help GIScience understand how people can communicate spatial thinking when describing their relationships with landscapes.

To research spatial precision in people's narratives, one may think it would not be possible to collect narrative data using GIScience's typical tools such as geographic information systems (GIS). On the contrary, with GIS's use in many aspects of people's daily lives (e.g., driving navigation, searching for shopping, or sharing one's social activities) qualitative, narrative data is being easily collected with GIS (Bolstad 2016; Nummi 2018). Beyond personal use, GIS has also been integrated into government activities as a public policy tool to collect and analyze narratives on how a policy can affect people's activities at the locations people are living their lives (Fu and Sun 2011; Kahila-Tani et al. 2015; Ramasubramanian 2010).

This use of GIS for both personal benefit or from government initiatives (e.g., having a web-based "311" system for citizens to report deteriorating streets needing repair, or with police departments analyzing crime occurrences by location to prioritize patrolling) has encouraged people to share narratives that emphasizes the social-emotional connections individuals have for places, sharing essentially what are called their *landscape values* (Brown and Weber 2012; Nummi 2018). Landscape valuation can provide a type of data that examines spatial precision in narratives when relative to the geographic area framing qualitative data collection. Unlike quantitative data where precision is dependent on a ratio/interval scales, spatial narratives have precision based on language that demarcates a feature within a data collection area. This means landscape values can contain components akin to a geographic coordinate system (GCS) that allow a quantitative, locational data point to be formed from qualitative narratives.

Landscape value data are also an interesting type of data for public policy crafting because the valuations garner different types of expectations from the data's producers, namely the public, as to how their data should be used. For instance, people who have a similar landscape suggest that their valuation will help build a sense of community and encourage people to express similar valuations at social events or grassroots demonstrations on social issues (Elwood 2006; Plantin 2014). Yet, when landscape values are collected by the government for policy planning, this generates more explicit expectations from the public as to how their landscape values should be considered in policy planning. The "public," defined in the broadest sense as being those who are not part of the government doing the policy planning (Brown and Donovan 2013), often stipulate that their landscape values are the most authentic representations as to how a landscape is experienced based on use, and therefore should significantly influence what a policy should accomplish on a social issue because the valuations come from such an authentic source (Kahila-Tani et al. 2015).

In addition to the increasing use of GIS for policy planning, governing bodies are more broadly starting to recognize that the public wants to play an active role in shaping policy, as policies will ultimately affect the places people are connected to emotionally (Brown and Donovan 2013; Engen et al. 2018; Plantin 2014). More importantly, when the public participates in policy shaping activities, governing bodies recognize that the public expects to see places managed using their perspectives, rather than an approach in which governments assume a priori how the public wants places managed based on proxy, demographic measures (Engen et al.

2018; Ramasubramanian 2010). Governing bodies have also realized that policy development methods that incorporate landscape valuation are limited, as since policy methods have traditionally valued an "information only", top-down approach for public participation activities (Birkland 2005). Driven by the increasing use of GIS by governments for collecting landscape values for crafting policy, a domain called Public Participation GIS (PPGIS) emerged to make sense of how people attribute emotions to places, and at what precision, including how governments could use GIS to gather and apply emotional-spatial data (Ramasubramanian 2010).

1.1. Landscape Values

Landscape values can be defined as the psychosocial emotions that people attribute to landscapes given that places can incite emotional experiences (Brown, Raymond, and Corcoran 2015; Brown and Reed 2000). As such, landscape values can motivate a person to invest time and resources in policy processes because these emotional connections to places allow a person to feel that they have a personal stake at how changes to a policy could affect changes to a landscape. Thus, if the public feels their landscape values are threatened because of policy change, and that those changes would cause their landscape values to be "harmed", the public would be motivated to navigate the often-complex public participation process to ensure their landscape values are prioritized in a policy.

Acknowledging that landscape values can motivate people to participate in policy processes is important because the public often finds the policy process cumbersome and frustrating (Birkland 2005; Ramasubramanian 2010). Even government "citizen guides" outlining public participation processes, meant to empower people by openly giving information on how-to participate in these processes (e.g., US Department of Agriculture 2016), implicitly admit collaborating with the government during a policy process is not straightforward. For people then to willingly engage in cumbersome processes, an underlying motivator must be acknowledged because qualitative research must have a context (i.e. a motivator) to ground research results and interpretations, even in circumstances where there is a high level of trust from the public that a government will make "appropriate" policy decisions (Engen et al. 2018). Landscape valuation then is that underlying motivator for why the public chooses to get involved in policymaking.

1.2. PPGIS

PPGIS is an example of how GIS can evolve to meet the spatial thinking needs of society. With the first GIS was built in the 1960s, early systems stored digitized geographic data that could be queried and visualized (Goodchild 1992). From then it wasn't until the late 1990s when the GIS community of researchers and users saw how GIS, along with other technologies, could empower the broadest form of the "public" for representation in public policy by providing the means to collect and disseminate place-based narrative experiences by bottom-up grassroot activism using technology to bypass established information authority sources (Plantin 2014). Along with the government's increasing use of GIS to collect and disseminate similar data, academia developed the domain of PPGIS. PPGIS studies the way in which GIS can not only shape how government policies should be created as data becomes more democratized, and but how governments could use GIS to improve the public participation process.

Research into PPGIS's successes and failures has created a canon of methodologies, theories, and application scenarios (Brown and Kyttä 2018; Plantin 2014; Sui, Elwood and Goodchild 2013; Ramasubramanian 2010). PPGIS is inherently multidisciplinary, borrowing paradigms from social and natural sciences to explain the socio-environmental interactions people have with places (Brown and Kyttä 2014). This emphasis on socio-environmental interactions however means that a great deal of PPGIS research has focused specifically on how land-use policy affects people's interaction with places such as nature preserves and other public lands (Brown and Donovan 2013; Brown and Weber 2012; Brown, Weber, and de Bie 2014; Brown and Reed 2000; Engen et al. 2018).

Yet this PPGIS research also looked at how affective valuations of a landscape could challenge policies through the public process which were not yet implemented. This is best seen with PPGIS "predicting" public challenges through conflict indexing, an analysis which compares competing public values or the collective public values against a policy's outlined impacts to an area. Such analyses show what changes to landscapes the public is willing or unwilling to accept (Ernoul et al. 2018). Indeed, these types of initial analyses using GIS showed how PPGIS expanded our understanding on how precisely articulated landscape values can influence policies, and thusly is why this project's work on precision spatial narratives should be thought of as PPGIS research.

1.3. SoftGIS

Another GIS domain that focuses on researching both government-driven and grassroots-inspired participatory engagement through mapping is soft geographic information systems (softGIS). For most researchers, softGIS is not that different from PPGIS, since both activities are typically driven by governments seeking landscape value data from the public (Rantanen and Kahila 2009). The difference between the two is in the type of data generated. Where PPGIS uses landscape value typologies so people can "place" digital point-pins on a map, softGIS collects qualitative landscape valuations, in the form of spatial narratives, based on a digital map-pin. The content of these narratives is usually thematically related to a single, open-ended prompt or a series of open-ended questions, both of which ask how a softGIS participant feels about a place. The digital map-pin that a participant places before giving their narratives is usually placed against a “clean” basemap (clean relative to other types of spatial data such as demographic information overlaid through census block geographies) (Kahila and Kyttä 2009).

For softGIS researchers, this qualitative data provides a narrative explanation as to why a person chose the landscape value(s) they articulated. With these narratives, researchers can use a content analysis schema to “code” narratives for the presence of certain communicative items, then analyze the quantity of codes detected for trends in communicative styles and strategies (Saldaña 2013; Steenbergen et al. 2003). With this methodology, researchers have stated that qualitative data can better show a person’s landscape valuation thought process, in terms of what experiences or geographic features help contribute to a person’s valuation (Cerveny, Biedenweg, and Mclain 2017).

For this benefit of having data that’s more revealing and descriptive of the landscape valuation process, these qualitative data could be limited in suggesting that one person’s valuation thought process is representative of a sampled population. Essentially, many researchers have stated that narrative, qualitative data are better suited for only determining a phenomenon’s attributes that could be present in a sampled population, not for directly measuring the presence of a phenomenon’s attributes in a sampled population (Montello and Sutton 2013; Moore 2004). Yet for the increasing use of softGIS to collect more-and-more qualitative spatial data, understanding what type of information can or should be extracted, and how that information should be extracted, from spatial narratives generated by softGIS and similar data collection activities frames of this project.

1.4. Deliberation Quality and the Influence of Spatial Narratives

Though softGIS research has continued to encourage the collection of qualitative narratives and helped with analysis process methodologies for government policy planning (Kahila and Kyttä 2009), a significant question remains. To what degree can qualitative spatial narratives influence the deliberation on shaping policy?

Answering this question is contingent on how deliberation is measured. Deliberative acts are the products of abstract, psychological processes (Hammersley 2011). Such processes are inherently difficult to capture since they can only be measured by proxy measures (Jaramillo and Steiner 2014). One such proxy measure explored by this project included quantifying the quality of discourse during deliberation. Exploring the components of spatial narratives using discourse quality provides an opportunity to measure the deliberation dimension of softGIS data using a vetted methodology that quantifies the components of spatial narratives through content analysis (Saldaña 2013).

By using a content analysis methodology to quantify deliberative discourse, the concept of spatial precision in landscape valuations can be integrated into this quantitative coding schema used on qualitative data. This integration is possible because content analysis in general has methods to add to the existing deliberative discourse coding construct that validated how spatial precision in narratives could be measured, so the quantified results are statistically reliable and valid (Montello and Sutton 2013; Saldaña 2013; Urdan 2017). When the spatial precision concept is merged with the coding schema to measure deliberative discourse quality, this proxy measure formulated the project's main research objective to validate the assumption that spatial narratives with more precise locations mentioned changes the quality of policy deliberation, more so than narratives with a lack of spatial precision.

On a basic level, how specifically does one measure a phenomenon like deliberative discourse in qualitative spatial data? This is something that has been asked through various lenses but not explored deeply (Kar et al. 2016). However, this lack of exploration makes sense within the spatial sciences, given that studying qualitative data is often understood as outside the realm of the field (see Bolstad 2016). Yet, given the public expects softGIS process will influence policy changes (Engen et al. 2018), understanding how the information generated from qualitative spatial data may influence policy merits examination. This project then explored whether measuring change in deliberative discourse quality could be achievable using a content analysis method from the field of discourse ethics.

1.5. Discourse Ethics

Discourse ethics looks at communication during an act of deliberation. Generally speaking, deliberation is an act of communication between parties on a divisive issue with the goal of finding a solution to the issue that satisfies both parties (Maia et al. 2017; Steenbergen et al. 2003). The elements around how discourse ethics studies the deliberative process was of interest to this project. Akin to a public comment submitted to change a policy decision, the deliberative process frames the act of "public participation" as a person persuading another to change the other's opinion on an issue. Using discourse ethics as means to quantify spatial narratives in deliberative terms is appropriate because qualitative data that comes from activities such as softGIS are data from a deliberative activity venue, even if the deliberation is not happening face-to-face.

Applying discourse ethics to qualitative spatial data analysis was done using a discourse quality index (DQI). This measures the discourse quality of the qualitative data while incorporating the spatial precision dimension. This project selected the DQI developed by

Steenbergen et al. (2003) based on comparing the DQI to other discourse quality methods available and critiques related to the DQI's discourse context limitations. To reflect the spatial nature of this project, the DQI was modified to reflect an assumption that simply stating how a place has meaning does not make for quality discourse. Instead, by describing a landscape value in precise spatial terms, i.e. naming a known geographic feature, point, or area, along with an accompanying narrative, deliberative discourse quality is changed (Brown, Raymond, and Corcoran 2015; Kahila-Tani et al. 2015; Zolkafli, Brown, and Liu 2017). The change in discourse quality subsequently should exert influence on the policy process.

Quantifying discourse is challenging due to the subjective and complex nature of communication and language (Hammersley 2011). The DQI though allows a qualitative dataset reviewer (or coder) to identify communicative actions taken by a person during a speech act to reach an agreement on how to address an issue through the deliberation of parties (in this case, between a public and its government). The discernable communication actions categorize the speech elements that produce a "better" argument (Bächtiger et al. 2010). By examining these communicative elements within a speech act, a DQI quantifies the process of formulating and presenting an argument at the scale of the individual. Quantifying qualitative spatial data at this scale is ideal since the landscape value data from softGIS activities are generated per person and the DQI measures discourse quality per party making a speech act.

Once discourse quality values are determined per speech act, the DQI schema does allow for each speech act's quality value to be aggregated so the overall discourse quality for the sampled population can be calculated. This calculation creates a baseline value to determine what, if any, communicative items or speech act parameters (e.g., gender, ethnicity, education, etc.) could influence discourse quality. Additional quality indices were created and segmented into communicative item categories, which helped show how certain communicative elements, such as referencing spatial precision, can affect discourse quality. This type of qualitative analysis makes the DQI superior to measures that examine how power dynamics in deliberative processes play out over time in active, face-to-face discourse settings (e.g., the Deliberative Transformative Moments measure) which for this project is inapplicable (Jaramillo and Steiner 2014; Maia et al. 2017).

The DQI has been critiqued in how it accurately measures all types of natural speech. According to Bächtiger et al. (2010), the DQI represents the most ideal form and function that a speech act can achieve. As such, this ideal form is a phenomenon that has not been documented. Because of this, the DQI is essentially a measure of how close a speech act is to achieving idealized discourse. Critics argue that comparing natural discourse to an idealized form characterizes natural speech unrealistically, such as the expectation that people can achieve the highest forms of discourse quality even if they do not understand the elements used to accomplish it. Furthermore, the DQI does not quantify the emotional components of natural speech (dramatic inflections, storytelling), and the degree to which they have a positive influence on a person's discourse.

If then the DQI measures how natural speech compares to the idealized form of "proper" speech, why use the DQI to ascertain the quality of natural speech to a theoretical level of discourse quality ? The communicative items that make up the DQI still best capture the most common discourse items that would most likely be used in deliberation, so the added spatial dimension is analyzed against expected and vetted items from discourse ethics research. The DQI is thus the best instrument to capture discourse change in qualitative spatial data.

1.6. Motivation

The motivation for this project was twofold. The first was to find community-based solutions that use spatial thinking in adequately capturing public policy perspectives (FRS and Brookings Institution 2008; Zuk et al. 2015). The second was to conduct softGIS research so the public and government bodies can share responsibility for communicating more effectively. Existing research suggests the public is frustrated with current public participation processes, which leave many to feel helpless with their government (Dorling 2010). Identifying these motivators also reveals the sources of personal bias that this project's author could inadvertently impart during the analysis and discussion of results. By being transparent as to the motivation, readers can determine for themselves whether such motivations created biases that compromised the project's objectivity.

1.6.1. Community Influence on Public Policy through Spatial Thinking

The use of spatial thinking for understanding the public's perspectives on policy is in demand because traditional policy processes are overly cumbersome (Brown and Donovan 2013; Kahila-Tani et al. 2015; Kar et al. 2016). For instance, when in the past a high-level policy expert's opinion on locating new local residential developments would have been found favorable, such perspectives are now increasingly distrusted. For many, expert perspectives have failed to capture local experiences, creating policies that were either not impactful or negative (Ramasubramanian 2010).

To replace the eroding confidence with expert perspectives, ways in which governments try helping the public to participate directly in policy creation has been well-researched (Birkland 2005; Brown and Donovan 2013; Engen et al. 2018; Kahila and Kyttä 2009; Kahila-Tani et al. 2015; Lopes-Aparicio et al. 2017; Nummi 2018; Ramasubramanian 2010; Rittel and

Webber 1973; Warner and Molotch 1995; Zolkafli, Brown, and Liu 2017). Yet citizens are not confident that their interactions with government will be reflected in new or revised policy (Engen et al. 2018; Kahila-Tani et al. 2015). This influences how the public perceives whether a public policy represents the people it claims to represent (Dorling 2010). As such, recent research has shown how community-based solutions improve collaboration and trust between the public and the government (Brown and Kyttä 2018; Kahila and Kyttä 2009; Kar et al. 2016).

Understanding how the public values landscapes can also contribute to this community-based literature, as landscape valuations are similar to social values that do not contain non-spatial attributes (Rantanen and Kahila 2009). Previous research even has found the potential for the generation of political power when these valuations are collected through softGIS (Elwood 2006). Given this potential it is worth investigating how landscape values can empower communities, as a shared valuation influences how a community advocates for a valuation to be represented in a policy (Kyttä et al. 2013).

1.6.2. Community Influence on Public Policy through Technology

Research has shown that the public's ability to influence policy is dependent on the public's access to government's information used to create policy in the first place. This research showed how government, top-down approaches using modern technologies, e.g. government saving costs by publishing content on websites, help the public gain access to the information and data used to formulate public policies (Fu and Sun 2011; Ramasubramanian 2010). Yet while the public has access to more information at a reduced cost, access to the technologies needed to review government material (i.e. broadband Internet) persists (Anderson 2017). This suggests that top-down approaches using technology are not as empowering as originally thought. Indeed, access to and control of data collection and distribution makes political power concentrated in the hands of those who have the technologies to create such knowledge (Elwood and Leszczynski 2013; Mitchell and Elwood 2012). Since landscape value narratives are thought to have influence on policy, and that the narratives are being generated through community-based technologies such as softGIS, qualitative spatial data warrants research given it has promise in reducing knowledge production and collection by governments.

1.6.3. Spatial Science Advancement

This research project contributes a new perspective within spatial science by applying non-spatial paradigms to spatial problems. Though PPGIS and/or softGIS researchers have developed methods for qualitative spatial data collection and analysis, neither domain has incorporated other disciplines to address the systemic spatial problem of how does qualitative spatial data influence policy and society. This lack of incorporation is unfortunate since understanding a person's landscape values requires understanding constructs on the valuation process from paradigms beyond spatial science (Brown, Raymond, and Corcoran 2015; Brown and Reed 2000). Through borrowing and modifying constructs from other disciplines, this project demonstrated how spatial sciences could find how spatial relationships are conceived based on how other disciplines view, and talk about, objects in a space.

1.7. Project Goals

This project sought to achieve two overarching goals which help it contribute new perspectives for softGIS research. First, to explore the way in which qualitative spatial data can be analyzed for its spatial dimensions just as other types of high-quality, quantitative spatial data. Second, that a DQI with a spatial component can quantify landscape values in qualitative spatial narratives to ascertain the influence these data have on crafting policies.

Historically, qualitative data, despite its richness and ability to document subtleties in language usage, is typically used in exploratory study (Montello and Sutton 2013). This has been the case because qualitative data is thought to only represent phenomenon as it occurred exactly in the time and space it was collected, a condition for data that the social sciences describe as having an *ethnographic present* (Moore 2004). Yet with increasing collection, this project assumed that qualitative data has "quality" to it since these data reflect on people's experiences and interactions at granular scales (Rantanen and Kahila 2009), scales akin to how data from the most precise GPS devices to measure one's location on Earth is considered to have equally high quality (Bolstad 2016; O'Sullivan and Unwin 2010).

The second goal of this project was to use a modified DQI for measuring whether spatial narratives changes discourse quality during a public policy creation process, in the context of a particular case study. This goal reflected the project's desire to successfully apply a paradigm from a non-spatial science discipline. Success in this case means that the project's results were reproducible to the same extent that the original DQI's results had achieved in its validation study. To achieve this goal however, reproducing the methods and results of the DQI required a research context. This project's context explored whether the quality of deliberative discourse changed when a precise spatial component was mentioned in spatial narratives during a policy revision process at a particular case study area.

1.7.1. Research Questions

There were four research questions (*RQ.[n]*) to show how the theoretical underpinnings to measuring spatial precision in narratives were investigated. The research questions also provided an outline as to what methodological steps were taken to answer the questions. One should note though, given this application of a non-spatial paradigm to research qualitative spatial data, these questions and subsequent answers should not be generalized to the sampled population, nor an entire human population in general. This is the case since one of the project's goals was on determining how well the DQI would work with qualitative spatial data. As such, it would not be appropriate for this project to extrapolate on trends observed in a sampled population if it was unknown how likely the measurement methodology was to accurately detect the trends being looked for (Montello and Sutton 2013). That said, the research questions can also provide the framework from which future research could start their explorations. The order of these questions was reflective of the deductive methodological approach that was employed:

RQ.1: Can spatial narratives be quantified from qualitative spatial data?

RQ.2: Can the discourse quality index (DQI) measure spatial precision in public comment spatial narratives?

RQ.3: Does locational precision of spatial narratives change the quality of deliberative discourse for this case study's policy revision process?

RQ.4: How do precise spatial narratives change the quality of discourse in this case study's policy deliberation?

1.7.2. Methods Overview

This project analyzed a case wherein landscape values were submitted as individual comments by a public for use in a policy revision process. Now considering that qualitative data collected from softGIS and PPGIS are for policy crafting (Brown and Kyttä 2018; Kahila and Kyttä 2009), the qualitative comments found from this project's case study area served as a proxy data source for the type of qualitative data that would have been generated from a similar type of softGIS activity. Using a proxy data source was necessary to ensure that the qualitative spatial data subjected to content analysis methods had a realistic deliberative discourse context.

This was needed to rule out that the analysis' results were due to the application of the measuring instrument, and not due to bias in the data that could have resulted from fabricating fictious comments for study. The case study area came from the Chugach National Forest (CNF) in Alaska, U.S.A., where public comments were collected as part of a process to revise policies dictating the CNF's land management activities. Analyzing the qualitative landscape values in the CNF's comments was accomplished by working through a sequence of five analysis tasks.

The first analysis task was devising how spatial precision would be detected during content analysis and determine how the spatial concept could interact with the other items in the DQI, so that spatial precision could be researched as to how it contributes to changes in discourse quality. The second analysis task was preparing and importing the data into a Computer Assisted Qualitative Data Analysis application (CAQDAS) for the content analysis coding. Once imported, the third task was coding the data based on the modified DQI that included the spatial dimension. For the fourth task, the coded data was checked for rater reliability and index item correlation to show that the DQI was reliably applied across three coding sessions to the data as intended, and that the DQI's measure of the deliberative discourse construct was validated. Finally, the fifth task calculated the discourse quality indices.

This sequence of tasks was based on the project's research questions. The tasks framed what type of data each task was meant to produce and how the information from each task helped in answering the project's goals. Before detailing the tasks, an overview defining the "public" that was expected to participate in the case study area's policy process is provided, followed by an overview as to how the concept of spatial precision was defined.

1.7.3. Analysis Assumptions

For this project, two assumptions were necessary with respect to defining concepts of the "public" and what spatial precision in qualitative data means. These assumptions were necessary to help calibrate the methodology, as to what the project should be measuring from the dataset.

1.7.3.1. Defining the "public"

The concept of the public is considered ambiguous (Brown and Donovan 2013; Pant 2014; Perkins 2010; Ramasubramanian 2010). Therefore, in the context of government policy processes, a "public" as defined by this project are those simply not working for the government initiating the policy crafting process. In this view, the public includes individual citizens, business groups, single-issue coalitions, and lobbying firms (Brown and Donovan 2013). This project's definition was appropriate as the focus was on measuring the discourse quality of spatial narratives rather than analyzing who was providing the narrative.

This definition though does overly generalize those typically involved in policy processes. Essentially, this generalization means for those who do not participate in this public comment submission process, they are assumed not to participate in, nor care about, any policy revision process. This definition also assumes that local government agencies do not participate in the policy process via comment submission, which is not always the case. More importantly, this definition assumes the political lobbying influence that different persons, groups, or organizations may already have with the USFS are all equal, which is usually not the case (Birkland 2005). However, these limitations appeared to have minimal effect on analysis since the overall majority of comments were from individuals.

1.7.3.2. Defining spatial precision for qualitative data

Typically, spatially precise quantitative data is measured using a variety of interval or ratio-based scales. With these measures, users of a dataset would know to the degree of certainty the location of a vector's geometry or a raster's coverage as oriented to a GCS or some other map coordinate system (Bolstad 2016; O'Sullivan and Unwin 2010). Yet with qualitative data, assuming the narrative does not state explicit coordinates as part of a speech, the use of interval or ratio-based scales to know the degree of certainty for a location stated cannot be had. Instead, a definition is needed to show how a person's speech on landscape values could be considered conceptually to have a similar type of spatial precision to that of quantitative spatial data.

Previous research into identifying the spatial precision of qualitative data is lacking (Brown 2012; Brown and Kyttä 2014). For this project, qualitative spatial precision was defined as speech containing language elements which describe the location of a geographic feature to the point that another person, familiar with an area surrounding said feature, could identify the same feature with a reasonable level of accuracy. This definition essentially assumed that spatial precision is dependent on first, identifying a spatial context which surrounds the features in question. Then second, this definition assumed that the highest form of spatial precision in a speech is based on how a described feature's geographic extent is relative to the spatial context. More details on 'spatial context' is provided in subsection 3.3.1.

This definition of spatial precision for qualitative data involved limitations. Unlike precision measured with interval/ratio scales, from which standardized measurement systems are made, precision in narratives must be relative to a study area in question (as outlined in subsection 3.3.1). Such relatively could allow a valuation in one context to be more precise while in another to be less precise. This comparative condition for spatial precision means that quantifying speeches can only be made using spatial contexts that are relatively in-of-themselves stable (i.e. have undergone limited boundary changes). For the project, this definition was appropriate to quantify the spatial precision of landscape valuations since the qualitative dataset's speeches were focused on valuations for features within a single, consistent spatial context which the comments' precision were judged to.

1.8. Case Study Area – Chugach National Forest

This project applied the DQI to qualitative data from a real-world policy process. The location for this project of this real-world policy process case study was the Chugach National Forest (CNF) in the State of Alaska, United States of America. This location was ideal for studying landscape values since the area has a landscape well-known and traversed by its surrounding communities. With such an area under frequent use, there was no shortage of landscape valuations to be measured for the project's goals. Additionally, with frequent use came a more intimate spatial knowledge of the CNF's geographic features and boundaries. This meant that the comments contained referencing to more precise landmarks, a key feature needed from the qualitative data for the project's goals.

The CNF was also an ideal case use area since the landscape was an actively "managed" landscape under the administrative authority of the US federal government. Thus, because the landscape was an actively managed one, it would not only logically undergo a policy discussion, possibly using landscape values, to outline how it should be managed, but that the government is obligated to have a policy dictating how the area is managed for a diverse set of uses (Brown and Donovan 2013; US Forest Service 2014). Given these obligations, subsequent public comments on policy were indeed focused on being deliberative to the issue of crafting a policy.

The administrative oversight of the CNF is conducted by the United States Forest Service (USFS). The CNF is the second largest forest in the USFS system at 5.4 million acres. Roughly

96% of the forest landscape is managed to "…allow natural ecological processes to occur with very limited human influence," and the remaining 4% targeted with "active management" as those areas have frequent human activity (US Forest Service 2014, 4). Nearby, urban settlements range in population size from approximately 9,600 (e.g. remote villages without primary road access) to approximately 300,000 (e.g., the City of Anchorage) (US Forest Service 2014, 7). As public land, the CNF is legally expected to generate different opportunities for diverse uses (1-2). The CNF then has opportunities for "tourism and recreation," fisheries, "wood products," and mineral extraction that does not include oil or natural gas (7).

The policy plan of CNF is divided into three geographic regions which dictate the day-to-day land management activities (US Forest Service 2014, 4). These regions are not the same as 'ranger districts' but based on community naming traditions. These traditions name regions in homage to the Western-European discovery and exploration of the area in favor of place-names given by the indigenous population living in the area prior to Western-European contact. Since these regions were referred to by local communities consistently in public comments and are used to orient visitors to the CNF, the project assessed the precision of the spatial components mentioned in the data based on these three recognized regions.

As shown in Figure 1.1 the geographic regions are the Copper River Delta ('Copper River' or 'Copper River Basin'), Prince William Sound ('PWS'), and the Kenai Peninsula ('Kenai'). The Copper River area covers 31% of the CNF and the management priority is primarily focused on conserving habitats for fisheries and wildlife. The PWS covers 48% of the CNF and is mostly water and scattered forested islands. In the western portions of PWS, there is the Nellie Juan-College Fiord Wilderness Study Area ('WSA', 'Nellie Juan Fiord', or 'Nellie Juan'), which is a landscape under observation for the consideration of a US Congressional designation as a formal wilderness. The Kenai covers 21% of the CNF and, due to its proximity to the City of Anchorage, sees the most frequent human usage (US Forest Service 2014, 4).

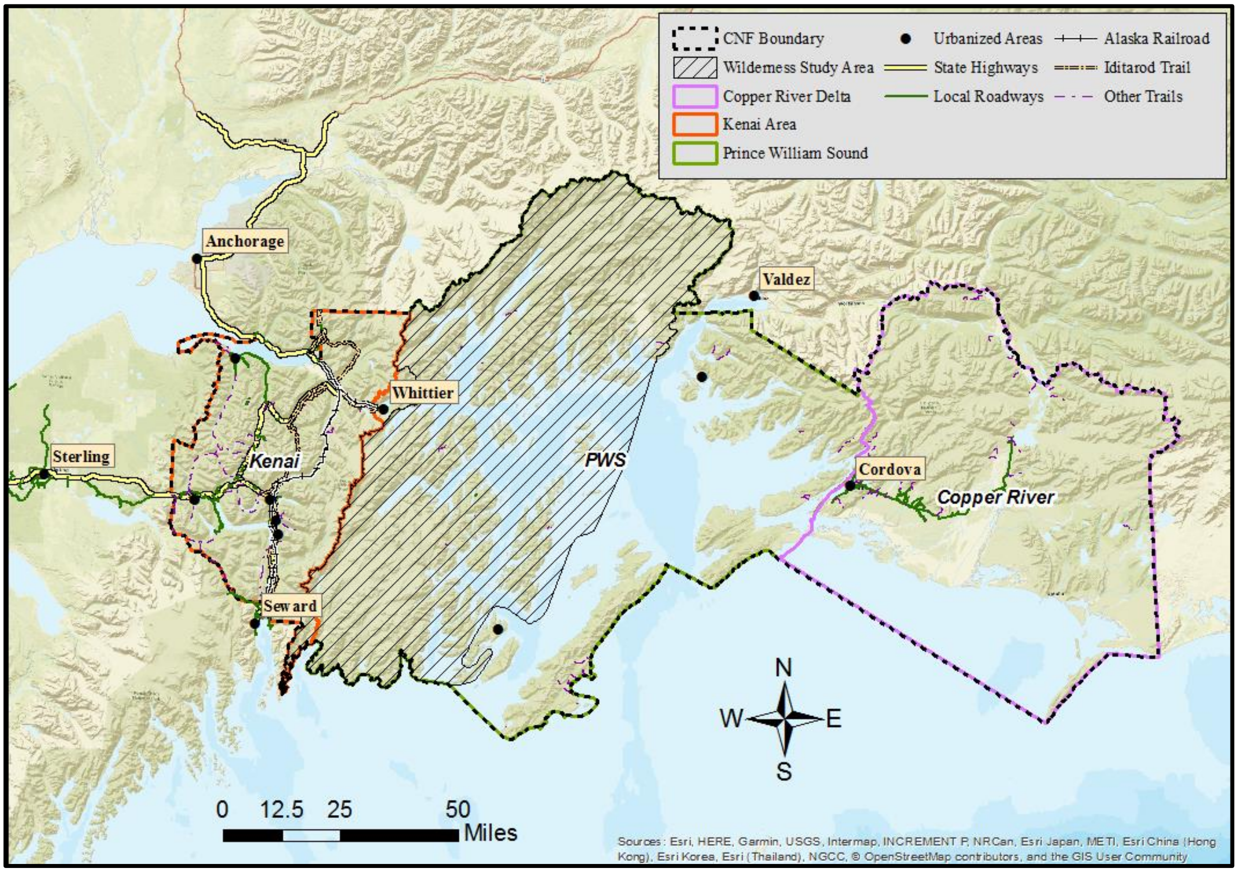


Figure 1.1. Case study area. Notice the geographic extents and proximity of roadways, trails, the Alaskan Railroad railway, and some of the frequently mentioned urbanized (i.e. built-up population settlement) areas in the public comments, to the CNF as a whole. *Source:* US Forest Service 2018a.

Chapter 2 Related Work

A literature review assisted in finding commonalities between theories and methods used between different disciplinary frameworks. Additionally, a literature review helped determine knowledge gaps, and how said gaps inspired this project. The literature review presented in this Chapter starts by exploring the concept and influence of precision in spatial thinking, and how that thinking is articulated via language. The review also explored how deliberative spatial discourse has been understood through PPGIS and softGIS. From there, landscape values and discourse ethics are discussed. Finally, spatial science approaches are evaluated to determine where this project fits within the broader literature.

2.1. The "Influence" of Precision in Spatial Thinking

A key construct tested in this project was the assumption that landscape values, when expressed in spatially precise terms, can change the quality of deliberative discourse more so than if landscape values were spatially generalized (i.e., not precise). An example of this assumption would be, if asked what the value of a forest is, when one person describes that an entire forest had recreational value that that landscape valuation is said to not be spatially precise because, relatively speaking, the valuation is being applied to the entire area in question. However, when another person describes that a forest has recreational value because of a trail within the forest, that valuation is said to be spatially precise because, again relatively speaking, the valuation is being applied to a geographic feature within the area in question. In the first instance the valuation is spoken broadly, whereas the second instance ties a personal experience to a specific location.

Intuitively, one may think landscape valuations do indeed change discourse quality when precise locations are included. This intuition may stem from the mindset that when a person says a whole forest has recreational value the person expressing the value could not possibly justify their emotional experiences at small scales. However, if a person mentions a specific location within the forest, it is more likely their valuation would be appreciated (i.e., their discourse has high quality) given that the specificity of the valuation would match the scale at which they are likely to emotionally experience a landscape in general.

Previous research on the role of precision in a person's spatial thinking, and how that precision is articulated, in relation to discourse is limited (Kar et al. 2016; Brown and Kyttä 2014; Brown and Kyttä 2018). In one instance, landscape values were examined to determine the autocorrelation between a valuation, and the geographic features that the valuations were intended to reflect on, as they were mentioned in qualitative reports submitted via PPGIS activities (Brown 2012; Brown and Weber 2012; Brown, Weber, and de Bie 2014). In another, one study did look at how qualitative narratives of places give valuations authenticity based on that valuation's expression between specific audiences (Elwood 2006). For the spatial sciences in general, determining the accuracy and precision of data is an ongoing concern (e.g., O'Sullivan and Unwin 2010). Yet for understanding qualitative data precision, in terms of building the case that a landscape value is accurate and precise with respect to the phenomenon or a feature being mapped, has not yet been explored.

Despite a lack of research on the role of exact landscape values, the value of precise spatial thinking is seen in the literature. For instance, Nummi (2018) demonstrated that a city's historic value is better appreciated by the public, and in turn better encourages a city to have historic preservation efforts, when those values are expressed precisely (i.e. this building here, or these two to three blocks of homes here). Wolf, Brown, and Wohlfart (2017) showed that recreational values within a nature preserve are discussed at the scale of user trail segments, demonstrating how individuals interact with the landscape and develop their valuations. Mitchell and Elwood (2012) showed that the precise location of historical events (e.g. a protest over racial injustices in the city's town square) influence perceptions as to how demographic groups should be treated. Overall, the literature seems to support the notion that precisely stating landscape values generates influence just as high-quality discourse generates similar influence during deliberative activities.

2.2. Defining PPGIS

Despite being recognized as a formal domain within GIScience since the late 1990s, the literature defines PPGIS still rather loosely. A key debate is to whether PPGIS is a tool to study the spatial extent of policies (Ramasubramanian 2010), a science studying concepts and methods for participatory mapping projects (Plantin 2014), or a meta-study as to how certain GIS technologies yield certain kinds of participation results (McHugh, Roche, and Bédard 2009). Prior to the 1990s, the term PPGIS was not used since these types of GIS use cases were limited in number. However, once U.S. federal government agencies began to use spatial data and local perspectives to justify grant funding, the debate increased as to how GIS for government public participation should be defined and researched (Ramasubramanian 2010). Even after the National Center for Geographic Information and Analysis (NCGIA) recommended the term PPGIS as a distinct subdiscipline within the geographic sciences, the definition remains fluid (Brown and Kyttä 2014; Kar et al. 2016). Regardless of a formal definition, it is largely agreed on that PPGIS essentially emphasizes the use of spatial thinking by leveraging geospatial technologies, so the public has access to the policy planning process.

Some state that other types of public participation GIS cases, such as those of PGIS, VGI, and softGIS, falls under the PPGIS domain (e.g., Brown and Kyttä 2014; Sui, Elwood and

Goodchild 2013). Others argue that there are differences between those types of public participation GIS cases and PPGIS. While these divisions between cases seem trivial, it is important to clarify what each type of public participation case does, in terms of the geospatial technologies used and how the public uses those technologies. This is important because each case has different goals with both the data collected and how the public is engaged. Ultimately, how a landscape value collection strategy is classified can elude to how that public engagement could be perceived as how likely the collected data will influence a policy process.

Furthermore, this case study area's engagement strategy also helped determine what type of spatial science research this project's analysis was suited for. By looking at how the above public participation GIS cases gather landscape valuations, and how those valuations are used, this project framed why understanding spatial precision in narratives is important. With PGIS, for instance, the geospatial "technology" used for soliciting spatial data is usually paper maps, where the expected outcome is to foster solidarity on a local issue for grassroot political activism (Plantin 2014). On the other hand, VGI uses web-based geospatial technology to collect almost real-time spatial data, essentially making the public act as "citizen sensors", and in some cases using data as a means of solving specific problems (Bolstad 2016). Somewhere in between, softGIS contains elements of both PGIS and VGI, where web-based technologies are used to foster solidarity on a local issue. For this project then, categorizing people submitting public comments as part of a policy revision process is a softGIS activity. This is so primarily because not only are comments collected as part of a web-based activity to engage the public, but the comments are not part of a real-time collection effort (Kar et al. 2016).

2.3. SoftGIS Defined and Its Usage

SoftGIS can be understood broadly as both a lens to frame human geography research (Kahila and Kyttä 2009; Vich, Marquet, and Miralles-Guasch 2018) and a methodology for collecting data (Rantanen and Kahila 2009). Though there are other interpretations, softGIS activities at its core consists of gathering qualitative spatial data to study socio-environmental interactions between people and landscapes (Kyttä et al. 2013). Given that there is more spatial science research being performed, including this project, based on qualitative data, softGIS warrants further discussions as to understanding the type of data it works with and how analysis with that data will contribute to spatial scientific inquiry (Brown and Kyttä 2018). In understanding what comprises softGIS data and analysis, this project worked to match its methodologies and interpretative perspectives so that they were similar to those used in other types of softGIS research.

SoftGIS is viewed as fitting with the current trend of using GIS for data collection by lay-people with little to no formal training in geographic data collection (Sui, Elwood, and Goodchild 2013). While typically not considered softGIS, both traditional participatory mapping (PGIS) projects (Plantin 2014) and research using volunteered geographic information (VGI) on landscape values (Nummi 2018) are characterized as falling within the softGIS framing as data collection efforts done by non-geographic experts. For this project, understanding that softGIS activities fits into a larger trend of using technologies to leverage political influence is important to framing why the public would choose to use softGIS technology and method to begin with.

Though PGIS and VGI are similar activities, softGIS is distinct in two ways. First, the maps used by softGIS are typically void of layered spatial data, i.e. boundaries or roads with attribute data. Instead, softGIS typically orients through a base map, e.g. with aerial imagery or a topographic map, as a means of basic orientation for data contributors. SoftGIS participants then add their landscape valuations based on an overarching data collection question to a “clean” map. For example, Nummi (2018) asked participants to mark and describe if certain buildings within an urban area as shown on aerial imagery had meaning (values) to them. By contrast, PGIS activities are usually driven by consolidating local knowledge on known features and/or continuous-field phenomenon (Ernoul et al. 2018; Plantin 2014).

Second, softGIS typically captures transactional interactions, or affordances, that people believe the environment “gives” to them. Affordances arise based on the psychological attributes a person ascribes to a landscape during their interaction with the landscape. For example, one could ascribe to a patch of forest an economic landscape valuation based on how a logger felling the trees there generates a sense of economic independence (Brown and Reed 2000). These transactional interactions are the result of wide ranging and complicated emotional processes through which people attach meaning to an inanimate landscape. Yet interestingly, like with other types of GIS activities that take measurements of temperature or rainfall for showing a snapshot of a phenomenon at a location, affordances as they are collected through PPGIS, PGIS, and VGI activities usually means that these data are interpreted deterministically (i.e. a landscape value exists only as recorded or it does not exist at all). As such, these types of GIS activities cannot capture the range of feelings people have for places because softGIS seeks qualitative data, usually in the form of narrative experiences (Brown 2012; Brown and Kyttä 2014; Kahila and Kyttä 2009). Research using PPGIS methods do not disparage that type of research, but rather illuminates differences between the quantitative and qualitative landscape valuations using GIS data collection.

SoftGIS's expansion has been bolstered by other technological developments such as Web 2.0 infrastructure (Fu and Sun 2011). Arguably, one of the reasons why softGIS activities are increasing is because it is more accessible to the public being a web-based activity (Kar et al. 2016). Through advances in computer processing power, more user-friendly interfaces, and lower costs of broadband Internet, readily available web GIS programs (e.g. Google Maps, ride-share apps, and social media) have shown people how they use spatial thinking in their daily experiences (McHugh, Roche, and Bédard 2009; Mitchell and Elwood 2012). In turn, the increased web GIS use has "trained" people to more readily identify how their place-based experiences (as they identify through the use of web GIS programs) could change with a change in policy (Brown and Weber 2012). Thus, as more people continue to volunteer their experiences through web GIS activities and generate spatial data (e.g., landscape valuation, rankings of importance, and narratives), the use of softGIS will be furthered along (Fu and Sun 2011). This expansion of softGIS demonstrates that the resulting qualitative spatial data will not only become more plentifully available, but that it has the chance to prove its value to researchers and for policy planning (Plantin 2014; Sui, Elwood, and Goodchild 2013).

As softGIS has been defined and its use been explored here, softGIS also seems as a methodology for researching qualitative spatial data appropriate for measuring discourse quality change based on spatial precision detected in the discourse. Using a different approach (such as those explained above) would be too deterministic in interpreting landscape valuations qualitatively. Transactional interactions people have with an environment need interpretative constructs to be translated into usable data for spatial analysis. SoftGIS's focus on qualitative data makes that room for other interpretative approaches, such as discourse ethics, to help understand narrative spatial data in the context of how landscape values may influence deliberative discourse.

2.4. Landscape Values

Human geographers understand people's place-based psychological experiences through the lens of landscape values. Landscape values are typologies that categorize people's thought processes when formulating how a landscape satisfies their sociocultural and emotional needs (Brown and Reed 2012). Though practical to use a structure that categorizes emotional experiences, this type of quantifying does limit the ability to understand the landscape valuation determination process. This happens because typologies can over-generalize how abstract thought processes, such as emotional place attachment, operate in a natural environment (Montello and Sutton 2013). Nevertheless, generalized typologies are suited for generalizing the geographic extents of these emotional experiences across landscapes (Brown and Reed 2000).

Despite the generalizations, landscape values research has shown how valuations remain consistent across time and space. Even if valuations change locations for a person, (e.g. from a forest to an open prairie) the valuations do not change if conditions prompting the valuation remain the same across different landscapes (e.g., trails in the forest and open prairie give both areas a recreational value, despite ecological differences between landscapes) (Brown and Weber 2012). Research has also shown typologies correlate between a value's ontological conceptualization and how a person would categorize a value based on their conceptualization. The values essentially can describe how people perceive locations without choosing from a set of categorizations (Brown and Reed 2000). From the spatial sciences perspective, this consistency with landscape valuations, in how people think about and apply them to environments, gives qualitative data credibility in accurately capturing people's location-based emotional experiences.

As stated before, landscape values are based on a person's psychological experiences. The term 'psychological experiences' generalizes the experience of a person when social and cultural identities influence one's affective response to an environment. From there a person assigns value to a place, giving the place a measure of value (e.g., valuation). The term 'valuation' generalizes a person's assessment that a place is worthy due to its personal emotional benefit (Brown, Raymond, and Corcoran 2015; Cerveny, Biedenweg, and Mclain 2017).

This generalized definition of landscape values is preferred since the quantitative epistemologies part of this definition connects the qualitative nature of our landscape experiences to a method for the quantification of landscape values. Using a narrower definition would mean that the quantification methods used on the landscape values could not be reproducible beyond an individual study site. That means for the analysis done in this project, such a method would be of limited use for spatial science research, which would be counter-productive to the research objectives outlined. This definition also provides planners a reason as to why policy changes can affect an individual's well-being if a policy alters their sense of place (Mitchell and Elwood 2012).

The landscape value literature is typically grouped within one of three research objectives. These are (1) research on defining value typologies (Brown and Reed 2012), (2) determining the spatial distribution of values across a landscape (Brown and Weber 2012; Brown, Weber, and de Bie 2014; Ernoul et al. 2018), and (3) measuring how accurately the values are indicative of a population's "true" valuation of a landscape (Brown and Reed 2000; Cerveny, Biedenweg, and Mclain 2017). Though research on landscape value typologies have matured, more recent research has explored the use of qualitative data to create new typologies, even if it is only used in a single study (Ernoul et al. 2018).

When determining the spatial distribution of landscape values, researchers typically use point-pattern analysis since values gathered from softGIS or PPGIS activities are usually placed as point features (Brown and Weber 2012), though in some cases they are polygons (Brown and Pullar 2012; Brown, Raymond, and Corcoran 2015). Understanding the spatial distribution of values can help suggest the management policy that would be best for an area, e.g. whether a coastal area needs better animal management if it is predominately valued for its wildlife viewing (Ernoul et al. 2018). Determining the spatial distribution of landscape values helps determine whether values were placed by random chance or as a deliberate act (Engen et al. 2018). Identifying if the spatial distribution of values exhibits significant patterning too can determine if valuations were the result of social susceptibility bias during the collection of values (i.e. people were placing values because of the values placed before) (Brown and Reed 2000).

Finally, though challenging to quantify, research seeks to determine if values placed on maps are similar to the same values expressed in non-spatial ways. Researchers hope here that valuation is consistent across the mediums of expression – speaking, writing, art – to confirm that softGIS or PPGIS approaches elicit principles that are deeply held normatively (Cerveny, Biedenweg, and Mclain 2017).

Value typology research looks at whether different values are employed to describe the same landscape. For example, in the context of urban green spaces, some state these spaces are important for their natural value while others state these spaces harbor cultural value (Pietrzyk-Kaszyn´ska, Czepkiewicz, and Kronenberg 2017). In another instance, users of multi-use trails in a nature preserve indicated that while recreation is appreciated generally, some forms of recreational activity are preferred over others, e.g., having recreational value based on the landscape's "ability" to improve an individual's health and wellness, versus having recreational value because the landscape has trailed access to showcase the preservation of an area's biodiversity (Wolf, Brown, and Wohlfart 2017). Along similar lines, in another study the value of urban density was seen as either an economic opportunity or contribution to community cohesion despite people identifying both under the same valuation (Kyttä et al. 2013). Similar research furthermore validates that landscapes means different things to different people, though many can agree to one overarching value typology (Wolf, Brown, and Wohlfart 2017). Research also seeks to understand whether values reflect a person's behaviors, or if a person is providing attributes to an object they value, i.e. to describe what that object "gives" to them (Brown and Reed 2000).

Though less prevalent in the literature, landscape values research has explored whether values influence a policy-maker's perception of place. Since landscape values are often collected in the context of a policy process, a common research question is whether these values are influential toward the policy being created (Elwood and Leszczynski 2013). Yet the answer to this question remains vague. More importantly, past research has not offered a method to measure the influence of qualitative data on policy processes (Brown and Kyttä 2018), which is perplexing given softGIS's goal to help people explain their value connection to places. The lack of research is indeed an additional source of motivation for finding a methodology to measure how valuations help influence policy.

2.5. Discourse Ethics

The field of discourse ethics looks at deliberation, a communication style that uses concept framing methods and articulation techniques to change an opinion held by another party.

Deliberation is not the same as a debate, where a debate is a formal setting that has rituals and rules for presenting arguments and counterarguments and those speeches are judged for the merit and presentation of a position. Deliberation is different due to its content and context- the subject-matter (content) is about a pressing issue that warrants communicative efforts where a compromise as to how to solve an issue is needed.

The context of deliberation is that the conversation between parties (people, not the political sense) becomes deliberative discourse because an issue requires a change in position on a subject by one or both parties in order to execute an actionable item related to problem solving (Bächtiger et al. 2010). Under this definition, discourse ethics offers an appropriate methodology that could measure the quality of qualitative softGIS data, as a means of quantifying the landscape values provided in the case study area's public comments. Thus, using discourse ethics methods here assumes that softGIS is essentially a digital venue for deliberation on an issue that affects landscape values held by the public. Furthermore, discourse ethics offers the perspective that deliberative actions are said to be influential, in terms of how a solution to an issue is agreed on, when deliberative discourse is thought of as having high quality (Brown and Donovan 2013; Engen et al. 2018; Wolf, Brown, and Wohlfart 2017).

Measuring deliberative discourse quality was important for the project since it helped explain how discourse changed deliberation. Discussing quality in deliberation is not a means of ranking discourse. Discourse that is not high quality does not necessarily mean the discourse is not capable of swaying opinions. Discourse ethics emphasizes that changes to deliberation outcomes should not be the result of aggression, in the sense of using threatening, bullyish discourse. Rather, discourse ethics observes that high quality discourse should be the influential factor as to how parties in deliberation can agree on an issue (Steenbergen et al. 2003).

Elements of quality discourse vary, but in general they encapsulate four tenets (Steenbergen et al. 2003). The first looks at the justification a person has on a position, e.g. citing sources for evidence or referring to trends that are observable by all parties. The second looks at how counterarguments are respected among participants, e.g. exercising empathy or sympathy (though this is not to acquiesce to the other argument on those grounds only). A third focuses on recognizing when an argument being discussed is for the "common good" (25), e.g. a perspective that offers solutions beyond the individual presenting the argument. Though 'common good' is a broad term, in general it should be understood as the recognition that solutions to issues will benefit beyond self-interest. Finally, quality discourse will "yield to force of the better argument" (Maia et al. 2017, 8), e.g. when discourse quality as a whole convinces another that the reasoning behind the solution being presented is considered universally trusted and accepted.

These discourse elements are a suitable frame to measure change in deliberative discourse among qualitative spatial data. Used alone, applying these concepts to narrative data would be limited to analyzing a single act of discourse. To operationalize then these concepts for quantitative exploration, research by Steenbergen et al. (2003) placed these discourse ethic components into an index, known as the discourse quality index (DQI). In the DQI, the discourse is weighted so that a single speech act can be quantified to measure the quality of discourse. The index measures discourse quality by coding discourse, as text or transcripts, as to the presence of certain deliberative discourse items present in a speech act. The DQI is meant to generate a statistically meaningful discourse quality value measure. This means that the items in the index are truly measuring discourse quality (given the index's item unidimensionality) and that the results are meaningful in the context of assessing deliberation (that the probability of the quality values measured would not as likely appear by chance). As explained below, the DQI is this project's approach to qualitative spatial data analysis.

Other methodologies for analyzing discourse ethics are not limited to indices. Some methods focus on reviewing how discourse can measure the proclivity for completing certain behaviors . Other methods measure how "well" (not quality, but rather content) discourse justifies an ideological position. Overall, the issues in measuring discourse quality are not quantitative, i.e. how accurate or relevant the measures are. Rather, issues in measuring discourse relate to determining when a measure is appropriate to use, based on the type of discourse being analyzed and the context for which the discourse is taking place (Hammersley 2011; Hepburn and Potter 2011; Wodak 2011).

For example, another type of index, the Deliberative Transformative Moments (DTM) (Jaramillo and Steiner 2014), found during this review showed potential for use here but was ultimately rejected. The DTM focused on how discourse acts trend throughout a deliberative process. An example is a group discussion between a police force and urban residents, where the DTM showed how the power bestowed by the government on a police agency can influence interactions within the public (Maia et al. 2017). As such, for this project the DQI is more suitable for understanding speech acts that are not occurring in dynamic environments.

2.6. Spatial Science Approaches Related to Project Goal

There is a dearth of spatial science research with respect to the previously discussed disciplinary paradigms and their applications. This is especially true with respect to qualitative spatial data influence intersecting with discourse ethics methodologies. Among the PPGIS and softGIS literature, research has focused on either the execution of GIS technology for public participation projects or anticipating how the survey results may affect policy outcomes (rather than using spatial analysis to validate the results) (Brown and Kyttä 2014; Ramasubramanian 2010).

That said, spatial analysis has though been integrated into landscape value research. Primarily, especially for PPGIS projects, this has focused on calculating indices of conflict to gauge where locations with differing landscape values are contentious with respect to land-use policies (Brown and Donovan 2013; Brown, Weber, and de Bie 2014). One case study investigated the spatial autocorrelation of landscape value point clustering to determine if the placement of values was relevant to the placement location (i.e., values were placed where people had access or experiences, not by random chance) (Brown and Weber 2012). Though calculating conflict indices are typical for landscape value research, followed by an occasional spatial autocorrelation analysis of landscape values, there were some unique cases that solidified how measuring change in discourse quality using qualitative spatial data is possible in spatial science research.

Cerveny, Biedenweg, and Mclain (2017) used qualitative data analysis of narratives submitted through a softGIS activity to show that the same landscape value can vary in meaning when it is expressed in words versus being placed as typological value point on a map. This is an interesting finding since it shows that the way in which landscape value data is collected can influence the value’s intended meaning, despite the fact that both forms of data collection collect the same emotions but in different formats. Thus, while a group may say they value a place for its recreation opportunities, the expression of that value may potentially create conflicts among users, even when everyone generally agrees to the same value but submitted that value through different means.

This case demonstrates at a minimum why a measure of discourse quality would be helpful when discussing policy issues. For example, when a position is taken on a land-use issue, the landscape value referenced is understood by the individual to be universally understood by government and individuals. But in relying on the notion that the value categorization is thought to be universally understood, that notion may reduce the argument's ability to sway a counterargument unless there is more context to clarify its expression (Cerveny, Biedenweg, and Mclain 2017). In such cases, methods such as the DQI can clarify how qualitative data values should be understood based on the valuation for its contribution to quality deliberative discourse.

In another study, Brown and Reed (2000) used discriminant factor analysis to predict how values cluster when policy strategies that will be implemented in an area are already known by respondents. An example is when valuations of wilderness cluster in the same area on a basemap because that area has already been proposed as having a wilderness designation. When it is not known ahead of time that an area is planned for wilderness designation, valuations of wilderness protection on a basemap may not be as clustered, perhaps reflecting affective responses to landscape more accurately, since people would not be tempted to place valuations where governments "expect" them to be placed. Discriminant factor analysis is more confirmatory as compared to collecting data to ascertain affective responses to a particular location. Truly, if one already knows what type of values will be associated with a location, one may not consider counterarguments. Values could also be related to by its object of value and not its inherent value. For example, knowing that an area is going to be a wilderness, a person may value this object (wilderness) because of A, B, and C, versus showing how this area is valuable because of its "wild nature".

Discriminant factor analysis was inappropriate for this softGIS-related project since it analyzes the way in which landscape values cluster based on the information presented ahead of the mapping activity. The project's analysis cannot measure changes in discourse quality if the deliberative arguments being made are already known ahead of time, making the detection of discourse change a moot point. Altogether, the DQI appeared as the most appropriate choice.

2.7. Gaps in Previous Research

Previous research has not employed a DQI to measure discourse change in qualitative spatial data. The reason for this gap is uncertain, though there are a few possibilities. Measuring discourse quality could not be thought of as an inherently spatial problem, therefore the spatial science research community may not feel it is appropriate to quantify qualitative data from softGIS and PPGIS activities. This may be rooted in the fact that deliberative discourse is a by-product of the collection of other spatial and non-spatial data. Regardless of the cause, this project seeks to address this gap by applying a novel methodology to a spatial science problem.

2.8. This Project's Contribution to Spatial Science

This project shows how methods from discourse ethics can measure changes in deliberative discourse among qualitative spatial data. This is a necessary exploration given that landscape valuations can be a meaningful way for governments to understand what places mean to people, and how policy changes could elicit feelings of acceptance or rejection of a policy. More importantly, by quantifying spatial narratives, this project offers a means for communities to understand the type of spatial narrative it might take in the future to sway policy makers, so policies respect the public's landscape values. However, focusing on a sampled population's qualitative spatial narratives for the CNF does limit this project's conclusions to be generalized to other populations or geographic regions. Nevertheless, from this project one should be inspired to at least replicate these methods and further along spatial science research using qualitative spatial data.

Chapter 3 Methodology

The Methodology Chapter overviews the qualitative dataset and analysis tasks used to achieve the project's goals. The 'Data Description' subsection outlines the dataset's fitness for use in answering the research questions and for content analysis. The 'Research Design' subsection outlines the specific content analysis methods, showing the steps to process, analyze, and calculate the statistical results needed to interpret the findings against the literature and research questions.

3.1. Research Design

The sequence of research tasks outlined in this Chapter demonstrates how the project was able to answer its research questions. The sequence also shows how the data was processed at each research task step to create a specific data product. The workflow presented shows what type of data or information product was created at each step and if those products were used in subsequent tasks. In this section, the specific tools utilized for each task are discussed.

3.1.1. Research Workflow, Tools, and Tasks Overview

Figure 3.1 shows the research workflow, outlining how the specific analysis tasks *(T.[n])* fit more broadly with the overall methodological underpinnings using broad-step groupings. The broad steps guided when the specific analysis tasks were performed with a certain data product or information in hand from another step. The specific analysis tasks also show how tasks were dependent on another task or broad-step.

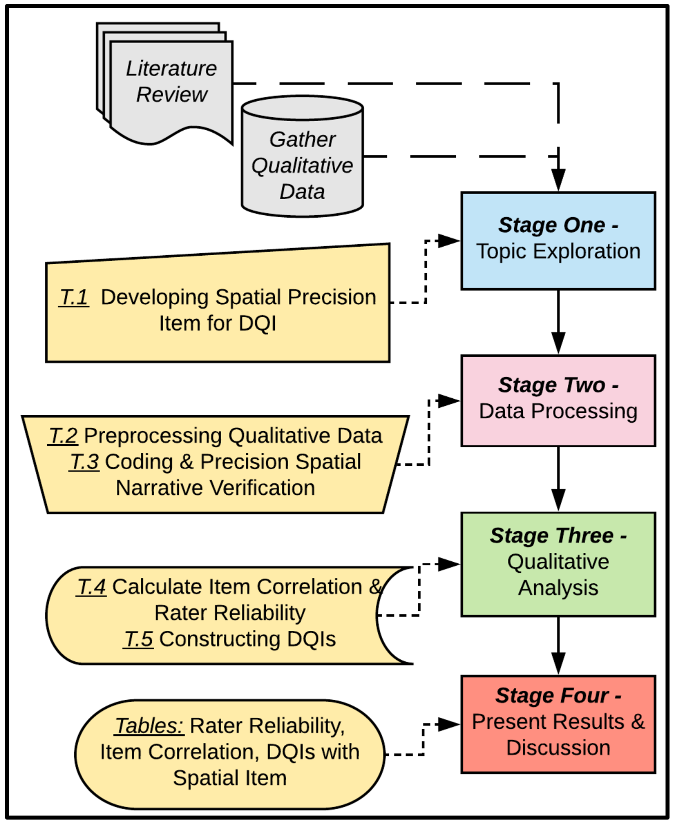


Figure 3.1. Research workflow and analysis tasks.

The bulk of the project focused on using content analysis with the qualitative data during the coding task (T.3 in Figure 3.1). This task relied on specialized qualitative content analysis software, which was *ATLAS.ti*. For the rater reliability and index item correlation calculations (T.4 in Figure 3.1), the item correlation was performed with open source *R* software, while *SPSS* was used to calculate rater reliability. The results of those calculations, along with the construction of the discourse quality indices (T.5 in Figure 3.1), were recorded using a *Microsoft Excel* spreadsheet. Each task outlined below explains how these tools were used.

Though not given a research task, the first broad step (labeled as 'Stage One' in Figure 3.1) was orienting the project's goals and research questions so the analysis results could be contextualized within the canon of previous research. This step resulted in the perspectives presented in the 'Introduction' and 'Related Work' Chapters. Such content framed why this project matters and what the results meant for the project's goals and spatial science. This step also entailed locating data that helped fulfill the project's goals. A detailed explanation of the data selected, and the process for its selection, is in section 3.2.

The first research task (T.1 in Figure 3.1) focused on determining how spatial precision could be detected and measured using a content analysis approach. This required anticipating how landscape values would be expressed spatially in narratives using deliberative communicative elements. After having identified the language to detect spatiality in narratives, the spatial dimension construct needed to be incorporated into the DQI. Incorporating the spatial precision item required that spatiality be identified using ordinal rankings to signify the magnitude at which a comment's landscape value was spatially precise. Since the original DQI research did not include information on how the current nominal items' ordinal weights were devised, a three-tiered logic was used to devise a ranking schema as to how spatial precision would be detected in qualitative data for this project. The explanation on how this ordinal ranking was devised is detailed in subsection 3.3.1.

The second task (T.2 in Figure 3.1) prepared the qualitative data for use with the content analysis software. The qualitative data needed preparation since the data was in the form of public comments written on PDF documents, as shown in Figure 3.2. Each public comment was submitted either by an individual person, with no formal statement on their connection to an organization, or by an individual on behalf of an organization. Sometimes, if either the person or organization addressed specific items from the CNF's revised plan, comments were submitted with additional documentation (e.g. comments written on organizational letterheads). All the comment documents were inspected using *Windows Explorer*, so only comments with text that related to landscape values were included. Each comment document was housed in one master comments folder. Once this process was complete, there was one digital folder containing 151 PDF documents of qualitative comments.

Date submitted (UTC): [redacted]
First name: [redacted]
Last name: [redacted]
Organization:
Title:
Official Representative/Member Indicator:
Address1: [redacted]
Address2:
City: Anchorage
State: AK
Province/Region:
Zip/Postal Code: [redacted]
Country: United States
Email: [redacted]
Phone: [redacted]
Comments:
I would like to comment on the possible change to the Western Prince William Sound Wilderness Study Area. First I would like to say I have been a resident of Alaska for 39 years and have boated in PWS since the mid 1980s and have a boat in Whittier since 2001. Our kids have been on the water with us since 2001 and I believe that this experience has given them a huge appreciation of nature, boating safety not to mention navigation skills boat maintenance and a respect for the environment.
Knight Island is a unique place in an absolute world class area. I would hope that no change would be allowed.
I would like to comment on something that is likely outside this area but I feel including Monatague Island should be included as a protected area.
[redacted]

Figure 3.2. Example of public comment and its metadata regarding the CNF policy revision. *Source:* USFS 2018b.

The third task (T.3 in Figure 3.1) coded the qualitative comments using the DQI, while extracting each comment’s spatial features and landscape values. Using the PDF documents from the first task, these were uploaded into *ATLAS.ti*, a type of content analysis software. Once the documents were uploaded, the DQI’s coding schema was programmed. *ATLAS.ti* then generated two project files with the documents and coding schema. Two project files were needed so that the two, first-cycle coding sessions, required to generate a rater reliability score, would not influence the second coding session with codes from the first. A third, second-cycle coding session was also performed on measures in the coding schema where analytical memos showed significant concerns with consistently applying the schema during the first-cycle sessions (see Saldaña 2013 for description of coding cycles and analytical memo documentation examples).

For content analysis research it is not ideal to have only one coder (Steenbergen et al. 2003), however this project's resource constraints did not allow for a second coder. Thus, the primary researcher coded and recoded the comment document groups with a minimum of one weeks-time between the first and second sessions. The time span between coding sessions was to allow an opportunity for the primary researcher to reevaluate if the index items applied during the first-cycle of coding were reflective to the intended meaning that those items were to encode. Having a second recoding allowed for refining the application of the DQI's items, based on the first cycle coding and closer scrutiny of the DQI's outlined application strategies that were missed due to the primary researcher getting acclimated to using the DQI in this project context (Saldaña 2013).

The third recoding session looked at the application of two items in the DQI, the 'Level of Justification' and the 'Content of Justification'. These items were singled out due to rater reliability statistics confirming what the analytical memos during the first-cycle sessions suspected of non-consistent identification of magnitudes for these two nominal constructs. Such low inconsistencies showed that the rater did not have a universalistic concept for the nominal constructs by which to consistently detect and code the presence of that item in a speech act. As such, this could have influenced other statistical analysis results to falsely assume that the DQI items had been applied to the comments as intended by the constructs. This third recoding then reevaluated the analytical memos against the original DQI research construct parameters to see if concepts from the original research were being applied to the project's dataset in a way that left little reasonable doubt as to the magnitude detected.

Each comment had a minimum of six codes, five from the original DQI and the one spatial item. With the six codes, the entire public comment dataset had discourse quality values calculated three times. The first quality index value emphasized the discourse quality for when precision spatial narratives were present. The second value index emphasized when the spatial narratives were not as precise as the preceding value here, while the third calculation showed how a lack of precision in the spatial narratives affected discourse quality. The coded qualitative comments based on the modified DQI items were then used with the fourth task.

The fourth task (T.4 in Figure 3.1) involved calculating the DQI item correlation and the rater reliability scores. These calculations validated two research concerns- one, that the DQI codes were applied consistently across the public comments, and two, that the spatial item incorporated into the DQI met the statistical unidimensionality requirement to show the spatial item was indeed measuring just the spatial component in the comments. The results from the two datasets of qualitative comments coded were inputted into an *Excel* spreadsheet in a crosstabulation format. This spreadsheet was then saved to a format for use in other statistical analysis software, e.g. *SPSS* and *R software*.

Calculating the rater reliability scores sought to follow the methods outlined in Steenbergen et al. (2003, 37-9), using *SPSS* to perform these calculations. From four reliability statistics the original research used, this project used ratio of coding agreement (RCA) and Cohen's κ 'kappa'. Spearman's *r* 'rho' correlation and standardized α 'alpha' were also run though not included in the results. The parameters surrounding the use of these statistics are explained below in subtopic 3.3.3.1. The item correlation calculation used Steenbergen et al. (2003, 39-41) method of polychoric correlation coefficients. These coefficients helped determine if the construct of spatial precision could have been incorporated into the DQI to measure discourse quality, or also known as if spatial precision had unidimensionality with the other items of the index. This is explained more below in subtopic 3.3.3.2. This calculation was executed in *R* software. The results of this task were not used in the remaining tasks but determined how accurate the DQI was for the coding and its application for these comments.

The last task (T.5 in Figure 3.1) constituted the project goal, namely constructing the DQI to ascertain how the quality of discourse among public comments changed when precise spatial landscape values were used. For this the coded comments from the second task were used. Employing the recommended method in Steenbergen et al. (2003, 41), DQIs were calculated using basic addition of all the items found in one comment and adding that per comment calculation to the whole comment dataset. *Microsoft Excel* was used for this task and for generating descriptive statistics on the indexes. The descriptive statistics were used to compare the changes in discourse quality among the different weights to indicate the level of spatial precision within the public comment dataset. A Paired Samples t test was also run to show if the difference between discourse quality values with or without the spatial item in the modified DQI was statistically significant, or that the presence of spatial precision in narratives showed significant influence on overall discourse quality. The results from this task are further discussed in the 'Discussion' Chapter.

3.2. Data Description

The qualitative data came from public comments submitted on proposed changes to a forest land management policy for the Chugach National Forest (CNF) in the State of Alaska, U.S.A. These public comments represented the discourse collected for a deliberative process. Acquiring the qualitative data was accomplished by downloading the public comments available for viewing through the CNF's free-access online reading room.

3.2.1. Exploration of Quality and Fitness for Use

The dataset would be considered thematically relevant if the narrative and metadata content had elements that could help in answering the four research questions. The dataset's completeness was based on whether its narratives would explain why the submitted landscape values should be considered as part of the CNF policy revision. To determine the overall quality of the data for this project's approach to content analysis, a dozen individual comment cases from the dataset were randomly selected for direct viewing. This viewing entailed interpreting the content of the metadata and narratives to anticipate the extent of the landscape values that could be expected in a larger dataset. From this initial review, the dataset was judged for its thematic relevance to the research questions. The dataset was also assessed as to its completeness in attributes and geographic coverage of the case study area. Completeness also evaluated whether the data's geographic content contained references to landscapes relevant to the CNF. The metadata for this qualitative dataset is presented in Table 3.1.

Table 3.1. Metadata for nonspatial qualitative data

Dataset	Source	Format	Date of Compilation	Population Sample
Public Comments of Qualitative Landscape Valuation	Chugach National Forest (CNF), USFS	PDF documents	Collected from Dec. 18, 2015 to Feb. 19, 2016	1,501

Source: Data from US Forest Service 2018b.

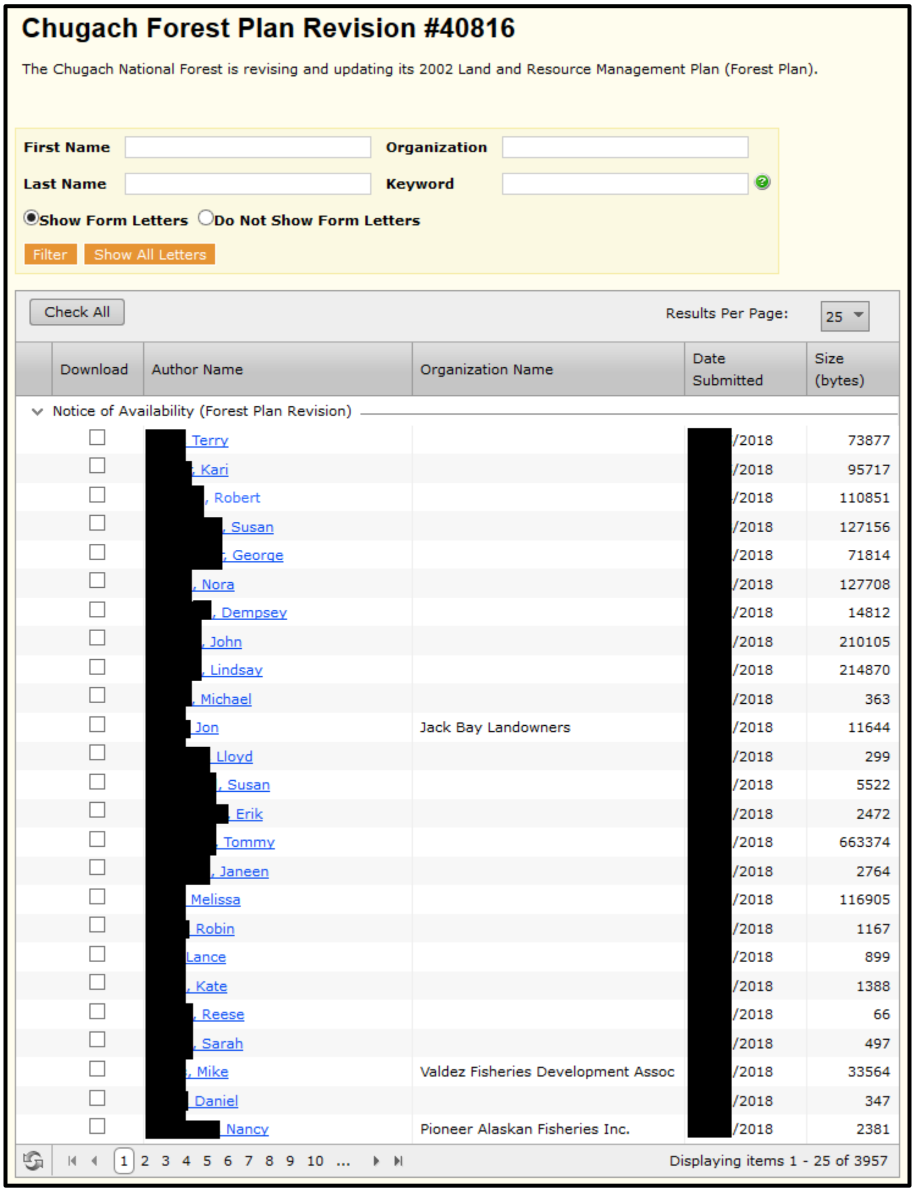
The fitness for use exploration showed the dataset was both relevant and complete, and therefore appropriate to the four research questions. The comments contained valuations which were intended by the public to influence the USFS's development of a land management policy. The narratives' content ranged from being precise in landscape valuation (geographically and logically) to fuzzy, i.e. broad statements as to preserving the environment in general. The metadata for each comment also consistently and clearly indicated when the comment was collected, from where (i.e. within the state of Alaska or beyond), and if the comment was submitted by an individual or on behalf of an organization. From this review, the project had surety that the dataset was appropriate for this type of qualitative spatial data research.

3.2.2. Sampled Population Data Selection

A sampled population for the case study area's qualitative dataset was used to measure changes in discourse quality. The population for the comment dataset consisted of those who claim to be users of the CNF, whereas the users here are considered in the broadest sense to be the "public" as defined by this project. This population, based on their claim of use, were thus most likely to have landscape values for the CNF, which subsequently should motivate these users to want to influence the policies that manage the CNF landscape.

The sampling frame consists of 1,501 public comments submitted to the CNF that were later published online. Fifteen comment groups of 50 comments per group, plus a 16th comment group containing one comment, were chosen through a random process. This sampling strategy was based on the objective to analyze approximately 10% of the comments available. A 10% sampling size for qualitative data analysis was acceptable when compared to other types of qualitative analysis research, including PPGIS with public participation rates usually between 10%-15% (Brown and Kyttä 2014), or as seen in the original research to develop the DQI where 56 cases from over hundreds of deliberative speeches were eligible for their analysis (Steenbergen et al. 2003).

To download the data, the organizing functionality of the data's online webpage viewer was used, where this project set the webpage to select 50 comments within its display. These selected comments on the page were then downloaded. This process was done arbitrarily starting with the first webpage display, as shown in Figure 3.3, then working through every odd webpage number, i.e. “1, 3, 5, 7,” and so on until the final webpage that displayed all the comments available was reached.



Chugach Forest Plan Revision #40816

The Chugach National Forest is revising and updating its 2002 Land and Resource Management Plan (Forest Plan).

First Name | Organization
Last Name | Keyword
Show Form Letters | Do Not Show Form Letters
Filter | Show All Letters

Check All | Results Per Page: 25

Download	Author Name	Organization Name	Date Submitted	Size (bytes)
Notice of Availability (Forest Plan Revision)				
☐	[redacted] Terry		[redacted]/2018	73877
☐	[redacted], Kari		[redacted]/2018	95717
☐	[redacted], Robert		[redacted]/2018	110851
☐	[redacted], Susan		[redacted]/2018	127156
☐	[redacted], George		[redacted]/2018	71814
☐	[redacted], Nora		[redacted]/2018	127708
☐	[redacted], Dempsey		[redacted]/2018	14812
☐	[redacted], John		[redacted]/2018	210105
☐	[redacted], Lindsay		[redacted]/2018	214870
☐	[redacted], Michael		[redacted]/2018	363
☐	[redacted] Jon	Jack Bay Landowners	[redacted]/2018	11644
☐	[redacted] Lloyd		[redacted]/2018	299
☐	[redacted], Susan		[redacted]/2018	5522
☐	[redacted] Erik		[redacted]/2018	2472
☐	[redacted] Tommy		[redacted]/2018	663374
☐	[redacted], Janeen		[redacted]/2018	2764
☐	[redacted] Melissa		[redacted]/2018	116905
☐	[redacted] Robin		[redacted]/2018	1167
☐	[redacted] Lance		[redacted]/2018	899
☐	[redacted], Kate		[redacted]/2018	1388
☐	[redacted], Reese		[redacted]/2018	66
☐	[redacted], Sarah		[redacted]/2018	497
☐	[redacted], Mike	Valdez Fisheries Development Assoc	[redacted]/2018	33564
☐	[redacted] Daniel		[redacted]/2018	347
☐	[redacted] Nancy	Pioneer Alaskan Fisheries Inc.	[redacted]/2018	2381

1 2 3 4 5 6 7 8 9 10 ... Displaying items 1 - 25 of 3957

Figure 3.3. Public comment webpage “reading room” site for the CNF policy revision process. *Source:* US Forest Service 2018b.

Within each downloaded comment group, 10 comments from 10 different members of the public were chosen for content analysis using a random number generator. This strategy was possible since each comment was given a document number by the USFS for their document tracking. This project used those same numbers to select which comments were analyzed. The random number generator was supplied by *Microsoft Excel*. There were nine comment selection rounds, where the random number generator was run per comment group. For all but two rounds, comments were selected using random numbers. In instances where the number generation resulted in low selection, i.e. one comment per round, or no selections after two or three rounds, comments were selected directly. The direct selection was based on reducing some of the uneven distribution of the comment group's tracking numbers at that point in the selection process (e.g., multiple comments with document numbers in the 1200s but none in the 1400s). Thus, either the researcher directly chose a comment based on its document number compared to the distribution of document numbers for the selected comments, or the number generator was rerun until there was a matching comment number. This random sampling method selected 151 comments for coding, representing approximately 10% of the sampling frame per the intention.

3.3. Research Task Details

These tasks presented in the workflow in Figure 3.1 are outlined in further detail here. Each task discusses its dependence on another task. How the specialized tools were used, and the data or information outputs these tools generated, are explained as well.

3.3.1. Detecting Spatial Precision in Content Analysis

The detection of spatial precision using content analysis was discovered during the literature review as plausible. This detection is plausible based on an individual's ability to exercise spatial thinking through describing how objects orient in a space (e.g., describing how to arrange furniture in a room, or verbally giving someone driving directions) (Cerveny, Biedenweg, and Mclain 2017; NRC 2006). The recognition of this formed the basis by which the project was able to develop a construct to detect the spatial precision of a person's landscape values. Afterall, if people already use spatial thinking to orient themselves and others as objects within a space, then the thinking should be applicable to describing how a person's landscape value connect with the landscape.

Identifying whether spatial precision could be extracted from narratives for this project required devising a means of quantifying a person's spatial precision. The quantification allowed for the use of statistics-based analyses methods to discern if an individual's communicative items, as identified in the existing DQI, share any sort of statistically significant patterning when spatial precision of a landscape value is had. In other words, quantifying spatial precision allows us to determine whether spatial precision correlates with other elements used in deliberative discourse, and if there is correlation, how the correlations between spatial precision and other items affects deliberative discourse quality.

Developing a methodology to quantify spatial precision using the modified DQI required looking at the potential for how landscape values could be articulated using language. As such, the project first looked to the existing research on quantifying spatial precision in narratives, for which this project had already presented that such quantification schemas are essentially nonexistent. Ergo, a custom detection schema was devised using the schema's similar to those used with the original DQI. In the original DQI, each nominal item had an ordinal ranking schema to "measure" the magnitude which that nominal item was present in a speech act. Those rankings were concocted using previous research in discourse ethics (Jaramillo and Steiner 2014; Maia et al. 2017; Steenbergen et al. 2003). Such research suggested that deliberative items are not used by people in binary terms. Rather, deliberative items are used along a continuum of intensities, and the demarcation between one intensity versus another can be seen using both explicit and implicit language (Steenbergen et al. 2003). For detecting spatial precision, the ordinal ranking schema was devised to reflect the notion that spatial precision is not a binary concept.

Comparison is necessary for quantifying spatial precision despite that it can also be subjectively applied. When using language to locate an object in space, spatial thinking research eludes to how the choice of words to describe an object appears dependent on the context of the subject in a speech act (Brown and Weber 2012; Cerveny, Biedenweg, and Mclain 2017; Elwood 2006; Engen et al. 2018; Kyttä et al. 2013; Mitchell and Elwood 2012; Nummi 2018; Plantin 2014). For example, should one be given directions to get to a lake, the person giving the directions may first ask where the other person is starting from. Upon understanding how the location of the lake is associated to the location of the second person, the person giving the directions would be able to orient the second person to the cardinal directions they would need to arrive at the lake. Thus, as presented in this case, the spatial context is an area that surrounds both the traveler and their destination. Without context, any sort of cardinal or orienteering-based directions would be meaningless, since those references to how one should orient themselves to move toward a destination would not be grounded in the space in which the references were intended. As such, landscape valuations could not be deemed to have spatial precision unless it had a spatial context by which to compare to a broader area for showing how much more surety the location of a landscape value has. Indeed, since the use of language to describe spatial phenomenon arguably creates a nominal measurement scale, having a comparative component for this nominal construct of spatial precision helps to quantify spatial narratives since the comparison allows to rank ordinally the precision intensity given a “baseline” measure.

With these concepts, the ordinal schema to quantify spatial precision followed a three-tiered logic along a continuum. Precision is had at a zero, one, and two magnitudes. The inclusion of a zero ranking is necessary to be in alignment with the other items of the original DQI, where a zero ranking is indicative of that item having insignificant presence in a speech act. These magnitudes correlate to the concepts of spatial precision outlined in Table 3.2. As with the original DQI's, items with higher number ordinal rankings indicates a stronger magnitude presence of that item. Thus, overall the less precise landscape valuations are mentioned, the less magnitude they have in the speech act itself. How the nominal construct overall correlates with the other items in the DQI is presented in the 'Results and Discussion' Chapter.

Table 3.2. Spatial precision item's ordinal weights for discourse quality index

Spatial Construct	Weight	Meaning of Weight
Beyond Study Area	0	No explicit mention of case study area in general or a feature within the case study area
Study Area Only	1	Explicit mention of the case study area in general only, without a mention of a feature within the case study area
Feature Within Study Area	2	Explicit mention of at least one feature within the case study area

Source: Marder 2018.

3.3.2. Content Analysis Approach

A discourse quality index (DQI) provides a means of analyzing qualitative comments. The non-modified DQI contained seven alphanumeric codes. Each code defines the communicative item that should be present in a speech act. The notion of a "speech act" encompasses the delivery of an idea from an individual to another using the communicative items (Steenbergen et al. 2003, 27). These communicative items accordingly are coded to show the magnitude at which an item is present in a speech act. Once coded, the numeric magnitude weights are used to calculate the quality of discourse. As speech acts consisted of a person's submitted comments, the DQI was applied to each comment. While not in real-time, a public comment was considered here to be part of the deliberative process and hence eligible for the

DQI to be applied. A detailed overview of the original index's items and its ordinal weights are in 'Appendix A.'

The 'modified DQI' for this project is shown in Table 3.3. The DQI was modified to eliminate items that were anticipated to have no variation in magnitude during content analysis. A lack of variation for an item's magnitude was interpreted by the original DQI creators as an item that would not contribute to the discourse quality of a speech act. Essentially, if an item was detected without variation, then it was assumed that the item has a magnitude which would neither contribute or degrade discourse quality. This is assumed as a lack of variation meaning the communicative item is considered normative for the discourse context, and therefore not as influential to discourse quality (Steenbergen et al. 2003).

Table 3.3. Modified discourse quality index's six nominal items and their ordinal weights

Nominal Index Item	Ordinal Constructs	Weight	Meaning of Weight
Level of Justification	None	0	Speaker states what should/not be done without reasoning to why
	Inferior	1	Speaker states what should/not be done, but reasoning to why has no linkage, or reasoning is based on illustrations
	Qualified	2	Speaker states what should/not be done and at least one reasoning to why has linkage
	Sophisticated	3	Speaker states what should/not be done and at least two reasonings to why have linkage
Content of Justification	For group interests	0	Speaker states argument to benefit one or more group interests
	Neutral	1	Speaker does not state argument to benefit a group interest nor for the 'common good'
	For common good, utility	2a[a]	Speaker states argument to benefit the 'greatest good for greatest number' (utilitarian terms)
	For common good, difference	2b[a]	Speaker states argument to benefit the 'least advantaged in society' (different principle)
Respect (for groups)	None	0	Speaker mentions only negative statements about groups participating or benefiting from deliberation
	Implicit	1	Speaker does not mention negative statements about groups participating or benefiting from deliberation, nor mentions explicit positive statements
	Explicit	2	Speaker mentions at least one positive statement about groups participating or benefiting from deliberation, regardless if there are negative statements as well

Source: Steenbergen et al. 2003; Marder 2018.
[a] Ordinal weight (2a) and (2b) having the same ranking weight, as creators of the original DQI deemed these reasonings have the same impact to discourse, yet should be delineated due to different reasonings applied.

Nominal Index Item	Ordinal Constructs	Weight	Meaning of Weight
Constructive Politics	Positional	0	Speaker offers no opportunities for reconciliation or consensus building to an issue being deliberated
	Alternative	1	Speaker offers for reconciliation or consensus building, but the offer is for another issue not related to the one currently in deliberation
	Mediating	2	Speaker offers for reconciliation or consensus building to an issue being deliberated
Respect for Counter-arguments	Ignored	0	Speaker flatly ignores counterarguments
	Degraded	1	Speaker acknowledges counterarguments, but also explicitly degrades it with a negative statement about the reasoning or other speaker presenting the counterargument
	Neutral	2	Speaker acknowledges counterarguments, but does not explicitly applies a negative or positive value to it
	Valued	3	Speaker acknowledges counterarguments and explicitly states it as having positive value to it
Spatial Precision	Beyond Study Area	0	No explicit mention of case study area in general or a feature within the case study area
	Study Area Only	1	Explicit mention of the case study area in general only, without a mention of a feature within the case study area
	Feature Within Study Area	2	Explicit mention of at least one feature within the case study area

Source: Steenbergen et al. 2003; Marder 2018.

The ‘Participation’ and ‘Respect (for the demands of others)’ items were eliminated since the dataset’s context assumed these items would be detected at constant magnitudes. For instance, ‘Participation’ measures the times a speaker during deliberation was participating or interrupted. For the dataset, participation would be considered a constant in this context since the project interpreted the submission of a public comment as a willing indication to participate. The ‘Respect (for the demands of others)’ item falls along similar lines. Since public comments are a mechanism to demand attention of the USFS requesting the narratives, the project assumed that a submitted comment was a demand for the narrative to be respected.

Upon eliminating two of the original seven items, a spatial precision item was added to the DQI to make the modified, 6-item DQI. The spatial precision item quantified the magnitude to which spatially precise landscape values were present in a comment. Spatial precision was determined based on detecting the mention of at least one geographic feature within the case study area boundary. For instance, those who mentioned a broad but similar landscape, e.g. "Save the forests!", the comment would not be considered to have any contributing weight toward a comment's discourse quality, due to the lack of spatial precision relative to the case study area. A comment with reference to the study area but did not mention specific features or points, e.g. "Save the CNF!", would be considered to have contributed weight toward a comment's discourse quality. Comments that mentioned specific features or points would be considered to contribute the greatest weight toward the comment's discourse quality, e.g. "Save Knight Island that's part of the CNF!"

An important point is the difference between the weights for all the items were not known. There was no way to know by how much one type of item quality is better than the other. For example, if a DQI for one speech act is "7" and for another speech act is "15", then the speech act with the higher DQI would be characterized as having higher quality discourse than by comparison to the other with the lower DQI. The degree however to which the speech act with a value of "15" is better than the other with a "7" is not eight. Rather the difference can only be expressed in greater than or less than terms. This was acceptable for the project since the research goal was determining how spatial precision in landscape valuations changes discourse quality against the overall dataset, instead of determining how the DQI's compared against each comment.

A generalized example as to how the index items were applied during the content analysis is provided in Figure 3.4. Using a fictitious public comment, the narrative is evaluated to determine the magnitude at which a nominal item construct exists. The magnitude that each nominal item exists were set by the original DQI creators.

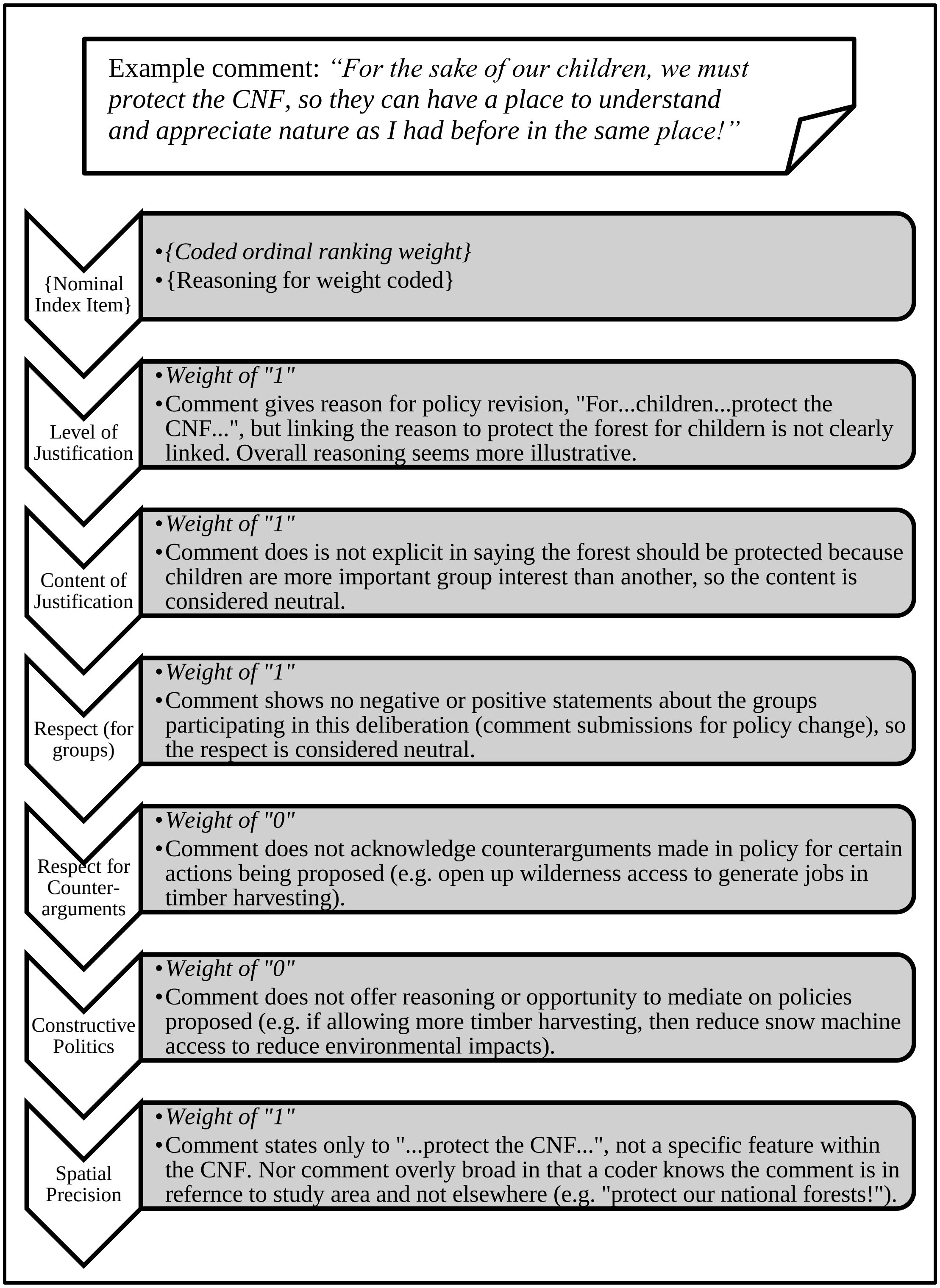


Figure 3.4. Generalized overview of process for coding narratives using the modified DQI.

To clarify this process, an example can be seen with identifying the magnitude at which the 'Level of Justification' is being exercised in a narrative. The original DQI creators assumed that a coder reviewing the narrative will use their preconceived notion as to how a person communicates rational, logic, and presents evidence to substantiate a thought on what should be done on an issue in deliberation. Though the original DQI does set thresholds in defining which magnitude to assign given the presence of specific communicative ques, initially identifying the constructs in the narratives is up to the coder and based on the coder's understanding as to what communicative ques signal that the index's nominal item is being exercised. Thus, the "reasoning" being identified is based on the coder's acceptance of the universally accepted construct of reasoning. Similar logic for the other index's items is presented in Figure 3.4.

3.3.3. Index Reliability and Validity Calculations

This stage involved calculating the DQI item correlation and the rater reliability scores. These calculations validated two research concerns. First, that the DQI codes were applied consistently across the public comments. Consistency means that the item constructs were detected, and their magnitude weighed as one would reasonably expect to detect and weigh those constructs in discourse. Second, that the spatial item incorporated into the DQI shows statistically significant unidimensionality with the index's other items. This is required to not only show that the spatial item was indeed measuring spatial precision in narratives, but that spatial precision as a construct is a deliberative, communicative element that can be measured in discourse just like the other items in the DQI.

3.3.3.1. Rater Reliability Calculations

Calculating the rater reliability scores sought to follow the methods outlined in Steenbergen et al. (2003, 37-9). In their original research, there were four reliability statistics calculated. These included the ratio of coding agreement (RCA), Cohen's κ 'kappa', Spearman's *r* 'rho' correlation, and standardized α 'alpha'. These rater reliability statistics quantify how consistently the index's items were applied during content analysis. Consistency in content analysis means that the item constructs' magnitudes were applied in a manner that matches the expectations as to how the item constructs should be detected in deliberative discourse. Thus, these reliability statistics elude to how the matching of these expectations should be for theoretically an infinite number of times that the index is applied (Steenbergen et al. 2003; Urdan 2017).

These calculations helped determine an important aspect of the index based on its item definitions. When there is "strong" rater reliability, the index's items constructs are being understood consistently between different raters, or that the items can be consistently understood across more than one coding sessions when there is only one rater. Such reliability means that the index's constructs are calibrated appropriately to be detected in the discourse dataset (that the definitions used to detect the item in narratives are not too broad, nor too confined for use in limited research contexts). Rater reliability scores then helped understand how the DQI's items are being applied to the public comments to detect the magnitudes by which the items are present in narratives. If the level of reliability calculated is not "strong," this could indicate that the rater has an inaccurate understanding of the items, and subsequently have inconsistent application of those items during content analysis (Steenbergen et al. 2003; Urdan 2017).

Strong rater reliability is typically considered to be calculated at ≥ 0.70 (Urdan 2017) and was calculated for this project per nominal item and per ordinal magnitude within each nominal item. These calculations must have at least two content analysis sessions, where the DQI was applied to "code" the public comments using the ordinal magnitude weights. The calculation is determined by comparing the number of codes that do not match between coding sessions to the total cases available to code. This generates the ratio of coding agreement (RCA), essentially a decimal-percentage showing the inconsistent coding results to the total cases available to code. Along with RCA, Cohen's κ 'kappa' looked at the likelihood that the codes were applied not by random chance. The results are a decimal-percentage, where values ≥ 0.70 (Urdan 2017) are considered to show that the ordinal magnitudes were not likely to be applied randomly. In other words, this means that when the current coding results are compared to a randomized dataset, it appears that the results seem to be more deliberate in their patterning, and therefore application, than if the codes were randomly assigned across all cases in the dataset.

Spearman's *r* 'rho' correlation and standardized α 'alpha' are focused on the ordinal dimensions of the DQI. Similarly, to the RCA and the 'kappa' calculations, these results quantify how consistent the distribution of the ordinal magnitudes were detected between at least two coding sessions. Yet unlike RCA and 'kappa', 'rho' and 'alpha' generate correlation coefficients to show how the magnitudes correlation in the dataset between coding sessions. As with the decimal-percentages, a correlation of ≥ 0.70 (Urdan 2017) indicates that ordinal weights distributions were consistent between coding sessions. This means that the ordinal magnitudes were being detected at consistent rates, once again showing that the item constructs were being understood and detected consistently. The project included them here to maintain methodological consistency from the original research, however their use was limited as explained in the 'Results and Discussion' Chapter.

3.3.3.2. Index Item Correlation Calculations

Calculating the significance of unidimensionality is necessary for item correlation analysis when working with an index for content analysis. The concept of unidimensionality concerns itself with determining the correlation between a psychometric instrument (e.g., an index administered to an individual as part of a psychological assessment, or the application of an index in content analysis) and the overarching construct that the instrument is intended to measure (Steenbergen 2000; Steenbergen et al. 2003; Ziegler and Hagemann 2015). For example, say one was developing an index to measure the magnitude of one's depression using two items that measured sleep quality and the sugar intake. Calculating the unidimensionality of this index's items would show how those two items would correlate to the concept of depression. If the items show correlation to the overarching concept being measured, then the index's items are said to have unidimensionality, or that the individual items in the instrument are appropriate proxy measures for the overarching concept being quantified.

This unidimensionality calculation determines the correlation using a variety of similarity coefficients, where correlations values between -1.0 and 1.0 are returned. The coefficients are usually presented in a table to show how each item in an instrument correlates to the other items. These results are interpreted against the theoretical underpinnings that were used to justify why the instrument item should have been included to measure an overarching construct. If the correlations are considered "strong," then the item could be said to have limited latency. This means that the item construct itself does not contain idiosyncrasies which could generate wide ranging errors as that item measures its construct (Steenbergen 2000; Ziegler and Hagemann 2015). For example, if the item construct of 'Respect' had used a magnitude scale of "1", "2", and "3" to quantify respectful language in a speech act, a strong correlation calculation result should also indicate that there is limited variance in magnitudes (that a speech act with a magnitude of "1" should be reasonably detected if the speech act was quantified using the same scale an infinite number of times) (Ziegler and Hagemann 2015). When an item has limited latency, the item itself could be said to be a valid construct to measure an overarching construct.

Strong correlations ≥ 0.60 therefore across all items in a results table indicates that the instrument's items have "internal consistency," meaning the strong correlations are so due to having "strong" associations with the overarching construct being measured (Steenbergen 2000). Strong correlations in the results also shows that items have an "external consistency," meaning that even if the scales used per item to quantify an item are different between them, they should not show correlation between the items themselves individually, but only when the items correlate to the overarching construct being measured. Seeing these consistencies in the calculation results reaffirms that the instrument is valid for measuring the overarching concept in question, even if it were applied an infinite number of times with other population samples (Urdan 2017).

Though necessary to have internal and external consistency for the index's item to bolster surety, item correlations should also not be expected to be perfectly correlated ($r = \pm 1.0$) against each other. In other words, while it is expected that the correlation calculations would show that the same item will have perfect correlation (as it should, since the inputs for that correlation calculation are the same), there should not be perfect correlation between two different items (e.g., between 'Spatial Precision' and 'Constructive Politics'). If correlations were perfect between two seemingly unrelated item constructs, this would indicate that the unrelated items could be measuring a same construct, or that the items are being interpreted by the rater as being the same thing (i.e., that the communicative elements used to describe spatial precision are one-in-the-same used to describe constructive politics). As such, during the index item correlation validity calculations, a factor analysis was run to ensure that the index items had correlations that were statistically differentiating from each other, so as to show items with strong correlations were not due to possibly measuring the same construct (Bhattacherjee 2012; Montello and Sutton 2013). This is known as calculating for convergent validity of the index's items, and the results are discussed briefly in the proceeding Chapter.

For the project, the unidimensionality item correlation calculation used Steenbergen et al. (2003, 39-41) method of polychoric correlation coefficients. This calculation used the discourse quality values, determined per index item, as presented in the table of 'Appendix B.' Polychoric correlation coefficients were used to ensure that this project's methods closely replicated those in the original research. This way, the potential for results to be interpreted as inconsistent with the original research due to methodological error could be reduced. The polychoric correlation coefficient calculation was considered appropriate to use given the index's ordinal scaled variables. When working with ordinal variables, sometimes the ordinal categorizations can cause attenuation on the bivariate correlations' normal distribution of values. As such, the polychoric correlation coefficient allows for a generalized estimate that considers the attenuation and violation of bivariate normal distribution (Rigdon 2010). Indeed, given the potential for natural speech acts to exhibit non-normal distribution of ordinal magnitudes from the index, this calculation is still appropriate even for this project's context.

This task of item correlation calculation seems to take this spatial science project beyond its methodological realms. Yet this task is necessary since it quantifies how a spatial item could be integrated as part of a content analysis methodology. Furthermore, quantification provides the degree of statistical confidence the concept of spatial precision could be considered just as valid of a communicative element as any of the other elements used in deliberative discourse. The unidimensionality calculation essentially provides the quantification needed to show how one's discourse quality could be influenced using varying magnitudes of spatial precision, based on how strongly spatial precision correlates with the other items in the DQI.

3.3.4. Calculating and Comparing Discourse Quality Indices

Calculating discourse quality assessed how the quality of discourse in public comments changed when precise spatial landscape values were used. Calculating discourse quality for this project meant that the values were looked at for changes in discourse quality based on the presence of how spatially precise narratives were detected at, based on the ordinal weights for the 'Spatial Precision' item.

Discourse quality is determined by adding the ordinal magnitude weights detected as follows in Equation 3.1. Note that the order is not significant, but is presented as such since this was the order which the items were introduced by the original research:

$$\text{(Justification)} + \text{(Content)} + \text{(Respect)} + \text{(Counterarguments)} + \text{(Politics)} + \text{(Spatial)} \qquad (3.1)$$

whereas upon substitution of the above variables for magnitude weights presented in Figure 3.4 results in the following calculation:

$$1 + 1 + 1 + 0 + 0 + 1 = 4$$

This discourse quality value for the comment is interpreted as having "low" discourse quality. However, it is more accurately to interpret discourse quality comparatively to other coded comments (e.g. less than or greater than the whole or subgroup comment dataset discourse mean).

The DQI codes calculated per comment were downloaded into *Microsoft Excel* to create a discourse quality table of values, where each row was a comment and each column was the calculated discourse quality per nominal item, with an additional column showing the total discourse quality value for that comment case. Discourse quality values were further aggregated from all the comments for a discourse quality dataset total. With this dataset value, descriptive statistics were calculated, including a median, standard deviation, and identifying the minimum and maximum discourse quality values. These types of statistics were also calculated as discourse values were reclassed based on certain comment metadata attributes to look at how those attributes could affect discourse quality change, e.g. if discourse quality is at certain values more so in comments that appear to have original thoughts versus containing form letter content. Calculating descriptive statistics for the entire dataset and reclassed datasets provided a means to describe in "greater" or "less" than terms how discourse values changed under certain parameters, since with ordinal rankings the degree to which change occurred cannot be determined.

Basic comparisons of discourse quality values reclassed under different metadata parameters helped to understand how those parameters could influence the magnitudes of spatial precision as well. These comparisons provided a quick means to determine if more calculations were needed to account for which comment parameters exerted more influence over a spatial precision value than others. Should certain metadata parameters, or all of them, appeared to show potential to influence discourse quality, the project would have proceeded by using other statistical t-test comparisons (see Urdan 2017) to isolate which parameters had the highest correlations. From there, the focus would have been on determining how the magnitude of spatial precision affected overall discourse quality under these parameter influences.

After evaluating how discourse quality values could be influenced by a comment's own characteristics, discourse quality values for the dataset were compared with and without the spatial precision item present. This was necessary to ascertain whether the difference between discourse quality values with a spatial item present was significant. This was determined by calculating if the difference for the mean discourse value for the dataset with and without the 'Spatial Precision' item was statistically significant.

Significance in this context means that the difference observed in means was not the result of random chance, but by a "treatment" condition that could account for the changes in values before the treatment and after (Albright 2018; Kent State University Libraries 2018; PSU 2018). The calculation used for determining significance was the Paired Samples *t* test run in *SPSS*. With this calculation, the difference of the mean discourse quality values from pre- and post-treatments are divided by the "standard error of the difference between the means" (Urdan 2017, 100). This produces a *t* statistic and a probability coefficient, both used to determine the likelihood that the difference in the discourse quality means is due not to random chance. With this result, the comparison between the discourse quality values with spatial precision detected against discourse values where spatial precision was not measured can be interpreted in terms of how significantly spatial precision in landscape valuation narratives influence discourse quality.

Looking at how the means between the paired samples was supplemented with an exploration into how the standard deviations (known as "SD" in the tables under the 'Results and Discussion' Chapter) between the spatial precision classes. This direct comparison of standard deviations showed how narrow discourse quality ranges could affect the magnitude of discourse quality change, from one level of spatial precision to the next. Looking at the standard deviations between dataset classes is often preferred since the calculation considers both the dataset's mean and variance, showing essentially the potential range that a measured value could exhibit even if the memberships per class differ (Urdan 2017). This means that when comparing discourse quality changes between classes, the standard deviations can help explain how consistently added spatial precision will change discourse quality.

Chapter 4 Results and Discussion

The results presented here focus on the discourse quality value calculated at a scale of the entire public comment dataset. By calculating discourse quality for the whole dataset, individual comment quality values can be reclassed into different types of subgroupings based on comment parameters. Having these subgroupings allows for comparison between parameters which showed whether discourse quality changed under certain comment conditions. Focusing the results at the scale of the dataset was necessary because quantifying measures that use ordinal scales need to have a secondary value to compare to a first, so that change in values were made appropriate to the scale of measure. As in this case, having a discourse value for the whole dataset to compare to values reclassed into subgroupings showed how discourse quality values in subgroups changed in either greater than or less than terms to the dataset as a whole. Subsequently, determining how spatial precision in landscape valuation narratives changed discourse quality was also focused at the scale of the entire comment dataset.

What these results will not focus on relate to how precise spatial narratives figure into discourse ethics. Based on the literature review, the project's analysis was conducted on the assumption that human speech contains language elements needed to describe how objects occupy or interact with a space (Bolstad 2016; Elwood 2006; NRC 2006). Thus, the results from the content analysis reflected on how the modified DQI quantified qualitative data to create a discourse quality measure. As these results are also being used to show if the modified DQI can be used across different study areas with other types of deliberation, the discussion context regarding these calculations should be limited to the sampled public comments and should not be extrapolated to generalize landscape valuations for the wider population.

This chapter explores the analysis results in three parts. The first part looks at the calculated indices for the dataset. The second overviews how the statistical reliability and correlation calculations validate the index as a measuring instrument. The third part reflects on what these results mean in the context of the research questions, in that whether the modified DQI was able to show that spatial precision changed discourse quality, and by what extent.

4.1. Measured Discourse Quality Values

With the scale of the content analysis focused on an individual's speech act, discourse quality indices were calculated for each of the 151 sampled public comments. For each comment, the DQI's six nominal items' magnitude values were added together. This summed value was the measured discourse quality for that individual public comment. The range of discourse quality for the entire sampled public comments was from a value of one to 13.

To understand how discourse quality was influenced by precision in spatial narratives, the individual comments from the dataset were regrouped into different comment parameter classes. With each class, new mean discourse quality values were calculated to show the discourse quality for a class of comment parameter. Classes included where public comments originated, the type of public comment submitted, and the level of precision used to spatially locate landscape valuations mentioned in a comment. Table 4.1 presents the quality value measured for the entire dataset. Figure 4.1 shows the distribution of discourse quality values in a histogram.

Table 4.1. Deliberative discourse quality, for sampled population

Index	Mean	Median	SD	Min	Max
6-component DQI (N = 151)	5.497	5.000	1.655	1.000	13.000

Source: Results calculated with data from USFS 2018b.

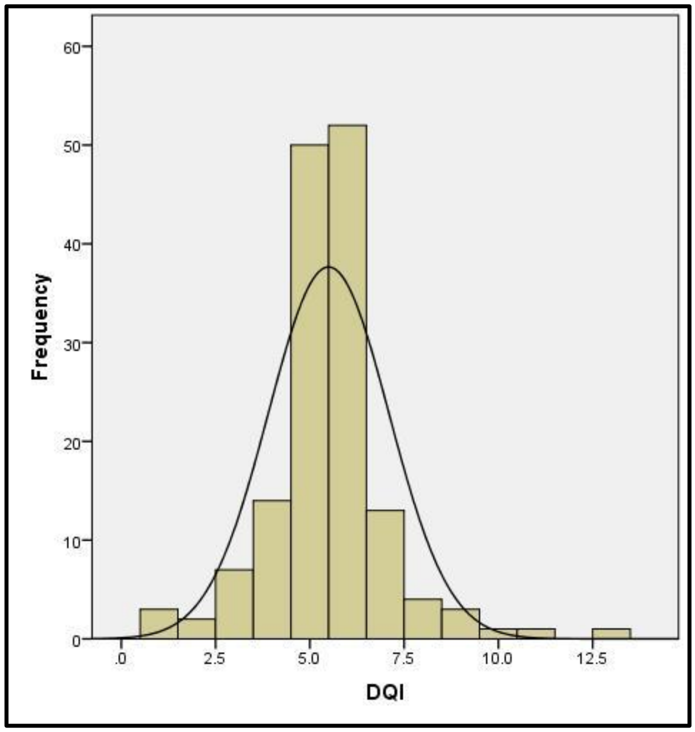


Figure 4.1. Histogram for the dataset's distribution of discourse quality values. *Source:* Data from USFS 2018b.

These quality values for the dataset showed a normal distribution. This distribution was expected, given the assumption that a public participating in deliberative discourse would be unlikely to exercise communicative elements which would result in greater than or equal to discourse quality given by that of a seasoned deliberator most of time (Elwood 2006; Elwood and Leszczynski 2013; Jaramillo and Steiner 2014). In turn, a normal distribution also makes sense since it is unlikely that a public would consistently have less than desirable discourse quality to communicate their landscape values, given the assumption that a public wants to clearly articulate their landscape values so that those values are understood and appreciated (Jaramillo and Steiner 2014; Mitchell and Elwood 2012).

Overall for the sample population, the deliberative discourse quality exhibited would be considered, on its own, to be of moderate discourse quality. The designation of having moderate discourse quality is subjectively based on comparing the mean discourse quality measured at 5.497 to the measure of 14 that could be had with this modified DQI, which would indicate that the speech act analyzed exhibited the greatest form of deliberative discourse ability that could be measured. Despite though the moderate quality, impassionate contributors were still able to generally articulate clearly what policy for the case study area should or should not be implemented. A sampling of these arguments, with differing discourse quality, are present in Figure 4.2 (caption on page 72).

It is time for the nations and people of Earth to set aside some significant environmental reserves where people may visit but they may not remove, alter, or denigrate the environment. Such reserves provide a biological plant and animal reservoir against species loss and a safe place for nature to evolve without the rapacious human destruction witnessed around the globe.

Comment A: Discourse Quality = 1; Type = original; From = unknown

I am writing today in an effort to highlight the importance of motorized access within the National Forrest service, specifically Chugach.

Motorized (Snowmobile) access here in Alaska provides many of us the opportunity to visit otherwise untouchable places of our beautiful State. The exploration not only provides enjoyment for many of us, but it also helps to raise awareness and create appreciation for our resources and parks.

Disregarding the stigmas some use to associate snowmobiles and the environment... Much of the rideable or skiable terrain would not be accessible without the use of snowmobiles. The Park Service Professionals go through great lengths to ensure riding areas aren't opened up prematurely and the terrain is as best protected as possible. To add to that, the level of education about "best practices" and safety being passed through organizations such as Chugach National Forrest Avalance [*sic*] Information Center (CNFAIC) and social media helps create a culture where we police ourselves. Not every person does the right thing all the time on either side of the highway, but I can assure you most of us go out of our way to educate and clean up after one another.

I hope you consider this any other opinions deeply and recognize the importance motorized access plays in both education, safety, and simply enjoyment within the NF.

Comment B: Discourse Quality = 5; Type = original; From = individual

My name is [redacted] and I am writing in support of expanding opportunities for Cross Country skiing in the Chugach National Park, in particular Turnagain Pass! A few weekends ago Girdwood Nordic volunteered to groom at small loop near the Center Ridge parking lot and it was magical! As we all know, our winters are getting warmer and warmer which means if we want to ski, we need to be looking at venues at higher elevations. We have many beautiful trails systems in Alaska but unfortunately, many of them are at sea level making them inoperable and unusable for Alaskans!

I know that I'm biased but Cross Country skiing is a sport that spans ages, gender, and economic class. The ability to XC in the winter makes people happy! On a personal note, it's the reason I moved here! When the loop was groomed at Turnagain Pass it was awesome to see all kinds of people with smiles ear to ear, enjoying the grooming and the opportunity to recreate in a low-impact way in a new place.

There is plenty of "wild land" and back country skiing in Alaska. I think we (Alaskans!) would really benefit from having an at-elevation option to Cross Country ski South of Anchorage. …

Comment C: Discourse Quality = 9; Type = original; From = individual

Figure 4.2. Examples arguments that were measured as having low (Comment A), medium (Comment B), and high (Comment C) discourse quality. *Source:* Data from USFS 2018b.

4.1.1. Value Based on Comment Parameters

Beyond looking only at the modified DQI's discourse items for influencing discourse quality, changes in values seemed to be influenced by certain comment parameters. For instance, quality appeared to change between comment types (i.e., thought to be comprised of solely original thoughts, made from pieces of a form letter, or was a non-edited, by the submitter, form letter. Comments thus classed as 'Appears Original' were measured as having less discourse quality than compared to comments containing form letters, edited by a submitter or otherwise. However, original content comments showed the greatest range in discourse quality. This observation seems plausible given that original thoughts would likely reflect a range of communicative styles since these comments were not constrained by the contents of a form letter (Elwood 2006).

Meanwhile, comments containing pieces of, or were un-edited from, form letters were measured as having overall greater discourse quality than comments solely with original content.

The discourse quality range though was limited (i.e., anywhere between values measured at four and nine, whereas the original content value range was between one and 13). This limited range of values though seems plausible since form letter comments would be constrained to show similar content across multiple submitters, and as such, to maintain coding consistency, comments with form letters were coded as similarly as feasible, regardless of their submitter. Thee reclassed discourse quality values results are presented in Table 4.2. It is important to note that statistical correlation calculations between comment parameters and a comment's discourse quality value were not calculated, since the project was focused on how spatial precision changes elements of discourse quality, not on how parameters such as these affect discourse quality. Furthermore, changes in discourse quality between the classes were also measured as minimal, which signified that the comment type parameter appeared to have minimal if any influence on discourse quality, so correlation calculations were deemed unnecessary.

Table 4.2. Deliberative discourse quality, for population sample, per comment type

Comment Type[a]	N	Mean	Median	SD	Min	Max
Appeared Original[b]	63	5.238	5.000	2.241	1.000	13.000
Form Letter, Edited[b]	30	5.833	6.000	1.147	4.000	9.000
Form Letter, Unedited[b]	58	5.621	6.000	0.671	5.000	7.000

Source: Results calculated with data from USFS 2018b.
[a] From 6-component DQI.
[b] Determined content was form letter based on comment likeness being repeated within sampled population.

Another comment parameter looked at for quality value influence included if comments originated from submitters living in the state of Alaska (AK), where the location of the CNF study area was, versus those living outside the state. Here, the largest range for quality value was measured in comments having been submitted from those claiming to live in the state. The overall discourse quality was also greater for comments originating from within the state (at

5.579), however the difference in quality between in and out-of-state comments appeared minimal (with out-of-state value at 5.478). These results are presented in Table 4.3.

Table 4.3. Deliberative discourse quality, for population sample, per comment origination

Comment Origination[a]	N	Mean	Median	SD	Min	Max
Within AK[b]	57	5.579	5.000	2.034	1.000	13.000
Beyond AK[bc]	92	5.478	6.000	1.279	1.000	9.000
Unknown[d]	2	4.500	5.000	0.707	4.000	5.000

Source: Results calculated with data from USFS 2018b.
[a] From 6-component DQI.
[b] Determined from comment metadata or explicit statement on where submission was from.
[c] Including international submissions (N = 1).
[d] Determined if comment metadata contained no information or no explicit statement in comment.

These results indicate for the project that a public comment's parameters appeared to have minimal influence on overall discourse quality. This was an important finding since it helped show that the measured discourse quality values do not have a significant amount of data noise, i.e. that discourse quality changes detected were not due to stronger influences coming from entities unrelated to the discourse quality items used by the public. Thus, when looking at how spatial precision changed discourse quality, the project in this context observed that quality value changes were not as likely to change because of a comment's parameters.

4.1.2. Value Based on Spatial Precision

Precise spatial narratives were detected throughout all comment types and from all points of origination. With spatial precision detected throughout all comment parameters, this raised the question as to whether comment parameters would also affect values per magnitude of spatial precision used in the modified DQI. If so, this could introduce additional data noise. For example, if comment origination showed to affect how often the greatest magnitude of spatial precision was detected, then discourse quality value changes would be not just based on the presence of spatial precision but by comment origination. This investigation then helped to show

how comment parameters influenced the magnitude of spatial precision detected in the public comments.

The discourse quality values per spatial precision magnitude per comment type is presented in Table 4.4. These results show how spatial precision was detected predominately at the greatest magnitude across all comment types. The results also show how discourse quality change was predominantly measured with comments considered to have original content while comments containing form letter content had the greatest spatial precision magnitude detected. These suggest that comment type could correlate with the amount of spatial precision present in certain comment types.

Table 4.4. Deliberative discourse quality, for population sample, per comment type and spatial precision

Comment Type	Spatial Precision[a]	N	Mean	Median	SD	Min	Max
Appeared Original[b]	Beyond Study Area	14	3.143	3.000	1.610	1.000	5.000
	Study Area Only	8	4.875	5.000	1.458	3.000	7.000
	Feature Within Study Area	41	6.000	6.000	2.098	3.000	13.000
Form Letter, Edited[b]	Beyond Study Area	--[c]	--	--	--	--	--
	Study Area Only	--	--	--	--	--	--
	Feature Within Study Area	30	5.833	6.000	1.147	4.000	9.000
Form Letter, Unedited[b]	Beyond Study Area	--	--	--	--	--	--
	Study Area Only	--	--	--	--	--	--
	Feature Within Study Area	58	5.621	6.000	0.671	5.000	7.000

Source: Results calculated with data from USFS 2018b.
[a] From 6-component DQI.
[b] Determined content was form letter based on comment likeness being repeated within population sample.
[c] No comments detected to this spatial precision.

Yet this type of correlation would be unlikely because the design of form letters would almost always guarantee a correlation between the greatest spatial precision magnitude and comment types using form letters. Thus, correlation between spatial precision and comment type was a false-positive correlation since the comment types using form letters are biased in the amount of variation for spatial precision magnitudes that could be detected (essentially that spatial precision is all but certain for comments using form letters, assuming the forms were concocted to have that magnitude of spatial precision). This bias however showed to not affect discourse quality overall, for instance, when form letter types were removed and discourse quality recalculated using the remaining classed comments. Taken together, though the analysis may lack variation in spatial precision magnitudes between comment type, the influence of type to spatial precision magnitudes appeared minimal, enough to state that the spatial precision a person used in their deliberative discourse was not a condition of comment type but a deliberate, communicative choice.

This finding for spatial precision and comment type appeared apparent with comment origination as well, as presented in Table 4.5. Precise spatial narratives from either origination made up greater than half of the comments submitted for this class. Though with more variation in spatial precision magnitudes, the results showed the distribution between origination appeared quite similar. The results then suggest that no matter where the comment came from, the likelihood of a comment exhibiting the greatest spatial precision had approximately the same chance. This meant comment origination did not appear to exert enough data noise to suggest that where a public comment came from would likely dictate the spatial precision to be detected. For the analysis, this finding solidified that spatial precision was not based on where a comment came from.

Table 4.5. Deliberative discourse quality, for population sample, per comment origination and spatial precision

Comment Type[d]	Spatial Precision[a]	N	Mean	Median	SD	Min	Max
Within AK[b]	Beyond Study Area	4	3.750	4.000	2.217	1.000	6.000
	Study Area Only	6	4.667	4.500	1.633	3.000	7.000
	Feature Within Study Area	47	5.851	5.000	1.989	3.000	13.000
Beyond AK[bc]	Beyond Study Area	9	2.778	3.000	1.481	1.000	5.000
	Study Area Only	2	5.500	5.50	0.707	5.000	6.000
	Feature Within Study Area	81	5.778	6.000	0.851	4.000	9.000

Source: Results calculated with data from USFS 2018b.
[a] From 6-component DQI.
[b] Determined from comment metadata or explicit statement on where submission was from.
[c] Including international submissions (N = 1).
[d] Not including comments with Unknown origination (N = 2).

4.1.3. Value Based on Case Study Area Geographic Features

The above results suggest that narratives using spatial precision was not only something the public can confidently articulate, but that their landscape valuations were scale-dependent. This meant the public was likely to associate their landscape values with precise spatial locations during deliberative discourse activities. The locations mentioned themselves however, relative to the CNF, did not suggest significant patterning upon geovisualization. Whether this lack of patterning was significant was not explored by the project since the focus was on the use of narrative spatial precision on discourse and not the location of geographic features themselves. The results of the top ten mentioned locations are in Table 4.6. The geovisualization of the geographic distribution of quality indices, and number of times a location was mentioned, are mapped in Figure 4.3.

Table 4.6. Deliberative discourse quality, per top-ten precise locations mentioned with counts of comment type and origination

Location	*Statistics*[a]					Type Count (N)[bcd]			*Origination Count (N)*[efgh]	
	N	*Mean*	*Median*	*SD*	*Quality Range*	Original	FL-Edited	FL-Unedited	*AK*	*(AK)*
Wilderness Study Area	*108*	*5.750*	*6.000*	*1.333*	*3.000-13.000*	22	28	58	*28*	*79*
Knight Island	*59*	*6.220*	*6.000*	*1.314*	*4.000-13.000*	8	21	30	*12*	*46*
Lake Nellie Juan	*55*	*6.127*	*6.000*	*0.818*	*4.000-9.000*	4	21	30	*8*	*46*
Glacier Island	*55*	*6.291*	*6.000*	*1.197*	*4.000-13.000*	4	21	30	*8*	*46*
Columbia Glacier	*54*	*6.278*	*6.000*	*1.250*	*4.000-13.000*	5	20	29	*9*	*44*
Port Wells	*50*	*6.140*	*6.000*	*0.857*	*4.000-9.000*	4	21	25	*4*	*45*
mainland Knight Island passage	*48*	*6.167*	*6.000*	*0.859*	*4.000-9.000*	2	21	25	*2*	*45*
Esther Island	*48*	*6.167*	*6.000*	*0.859*	*4.000-9.000*	2	21	25	*2*	*45*
Perry Island	*48*	*6.167*	*6.000*	*0.859*	*4.000-9.000*	2	21	25	*2*	*45*
Culross Island	*46*	*6.261*	*6.000*	*0.743*	*4.000-9.000*	0	21	25	*0*	*45*

Source: Results calculated with data from USFS 2018b.
[a] From 6-component DQI.
[b] Determined content was form letter based on comment likeness being repeated within population sample.
[c] FL-Edited = form letters whose content were revised prior to submission.
[d] FL-Unedited = form letters whose content were not revised prior to submission.
[e] Determined from comment metadata or explicit statement on where submission was from.
[f] Not including comments with Unknown origination (N = 2).
[g] Including international submissions (N = 1).
[h] *(AK)* = comments from out-of-state.

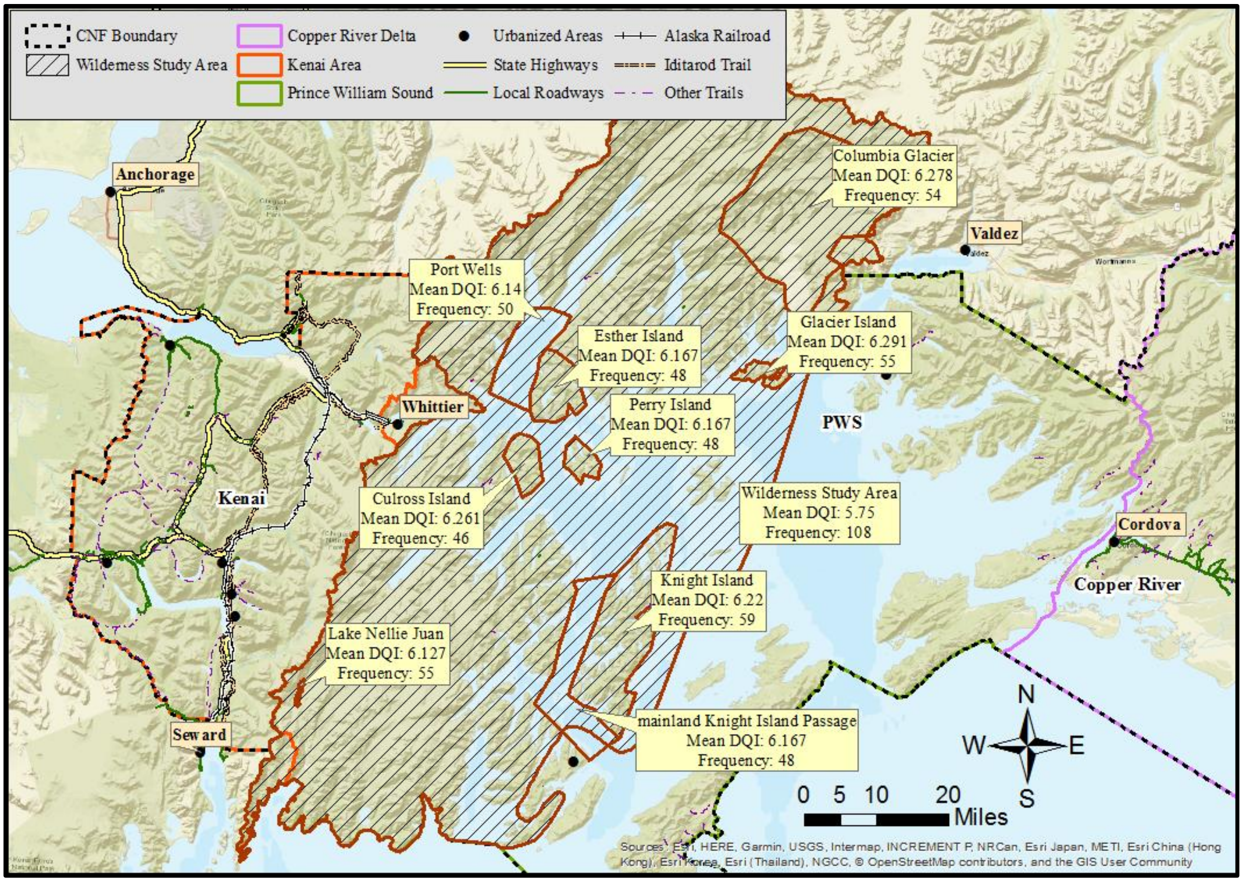


Figure 4.3. Geovisualization of discourse quality and frequencies of the top ten precise spatial locations mentioned in the public comment dataset. *Source:* Results calculated using data from USFS 2018b.

4.1.4. Statistical Significance of Discourse Quality Values

All of the above calculated indices must be interpreted in the context of statistical calculations used to ensure confident rater reliability and construct validation by means of correlation coefficients. These calculations contextualize that the DQI was applied as intended, and furthermore that the dataset was appropriate for the modified DQI to be applied. These calculations essentially showed if the discourse quality values measured with the modified DQI were measuring the construct of discourse quality. Thus, with these calculations shown below that the index's items, including the added spatial item, were appropriate for use in measuring discourse quality for the public comments, then the calculated discourse quality values should confidently portray how precise spatial locations affects discourse quality (Steenbergen et al. 2003).

4.2. Statistics for the Index's Measurement Reliability and Validity

To maintain methodological consistency, the modified DQI used the same index measurement reliability and validity calculations used with the original DQI. The first calculation performed was quantifying how consistently the modified DQI's items were applied to the qualitative data across the three coding sessions performed, generating what's known as rater reliability statistics. Calculating rater reliability statistics are meant to show that the modified DQI's item constructs were applied to a speech act's content in a deliberate and thoughtful manner. Though all of the index's nominal items were always considered detected in a speech act, this statistic was important to verify that the items' magnitudes were being detected across the three content analysis sessions not at random. Consistency in this sense refers to how accurately the rater was coding the public comments based on the construct that was being detected, that across coding sessions the rater was consistently detecting an item such as 'Respect for Groups' and reasonably applying a magnitude to measure the intensity of that item.

The second calculation showed the index's item correlations. Item correlations confirm that each item measured the discourse element construct it was meant to. This means that the index's item should not be measuring another item construct (based on how similar two measure's distributions are in the dataset). In turn, to show the modified DQI was measuring the concept of discourse quality, this calculation was also meant to show that the index's items shared unidimensionality, or that the index items' share in correlations enough to show that the items as combined in the index were measuring discourse quality. Thus, calculating item correlation also verified if the added 'Spatial Precision' item, and the construct of spatial precision in general, could have been considered a deliberative discourse item that could be detected and quantified in discourse. Essentially this second calculation was for validating that the discourse quality values measured could be considered accurate measurements of the dataset's discourse quality.

4.2.1. Rater Reliability

The four columns of Table 4.7 shows two rater reliability statistics. the first are the mean rater reliability scores, as discussed in the 'Methodology' Chapter as having the ratio of coding agreement, or RCA. Second are the Cohen's κ 'kappa' scores in the second two columns, showing the measure of probability that the codes were not applied randomly during the coding sessions. These statistics were aggregated as means for each of the modified DQI's nominal items between three coding sessions. These are mean results due to both the reliability and kappa scores originally calculated for each item weight contained per item. Reliability and kappa scores were calculated for all comments in the dataset (n = 151). The first columns for RCA and kappa were the results based on the rate of agreement between the two, first-cycle content analysis coding sessions. The second columns for RCA and kappa show the rate of agreement between the second, first-cycle session and a third, second-cycle recoding session. This third recoding however was focused on only rectifying inconsistencies in coding with the 'Level of Justification' and 'Content of Justification' items. A third recoding session was needed to solidify on a process for detecting and identifying a magnitude for these two index items, so that the process would be similarly consistent as it were with the other index's items.

Table 4.7. Mean rater reliability and Cohen's kappa scores, per index item

Index Item	Between 1st & 2nd Coding RCA	Between 2nd & 3rd Coding RCA	Between 1st & 2nd Coding κ	Between 2nd & 3rd Coding κ
Level of Justification	0.798	0.814	0.460	0.499
Content of Justification	0.744	0.872	0.351	0.605
Respect (for groups)	0.943	0.943	0.549	0.549
Respect for Counterarguments	0.955	0.955	0.454	0.454
Constructive Politics	0.940	0.940	0.866	0.866
Spatial Precision	0.982	0.982	0.886	0.886

Source: Results calculated with data from USFS 2018b.

The RCA scores show that the rater had agreed (or matched) with the magnitudes applied across the three coding sessions at least greater than 70% of the time. The kappa scores indicate that the probability of the rater having not applied the codes to the comments at random across the coding sessions was on average at least greater than or equal to 50%. In consultation with the reliability scores found in the original DQI research, the item construct's magnitudes here could be interpreted as having been identified and weighed consistently across the coding sessions. The results then suggest the item constructs were built on universally understood connotations as to how those items could be consistently detected in deliberative contexts. Should these scores have been lower, that could suggest the DQI's item constructs were either too broad for identifying specific instances of that construct in content, or that they were too specific in that the construct could only be detected in very tight instances in content (Urdan 2017).

Despite the scores indicating a high level of confidence with reliably and consistently using the modified DQI, these results show areas where rater agreement was not meeting the most ideal conditions for having even higher rater reliability scores. As a result, this instigated a third recoding session for only a few items with the index as described before.

For instance, rater agreement for the 'Level of Justification' and 'Content of justification' items were consistently lower than with the other items. This finding was most likely due to how these constructs' demarcations were built between what was considered "illustrative" justifications versus a “complete inference” instances. Illustrative justifications for example broadly defined the involved parameters of an issue and had loosely linked cause-and-effect statements, e.g., “If you don’t protect the CNF, more trash will show up in our streams!”. A complete inference, on the other hand, defined the involved parameters precisely and left little doubt as to the cause-and-effect linkages, e.g., “If you placed restrictions on the size of camping groups at Rock Campground, lesser-sized groups are more likely to pick up trash after themselves, which in turn means that trash is less likely to end up in our streams due to storm runoff, wind, and animals picking it up and carrying it away.”

While these were clearly defined, both justifications were difficult to code consistently since the original DQI’s parameters stated both implicit and explicit justifications were acceptable to detect and code (Steenbergen et al. 2003, 27-30). This coding parameter made it difficult to decipher if illustrative justification content could pass for an implicit justification, or that an illustration was essentially a failed explicit justification. An example of a comment using illustration that could be interpreted either as implicit or explicit is shown in Figure 4.4.

> …The Forest Service should not implement any plant [*sic*] that would allow residential timber harvests, expanded motorized uses and manipulation of habitats, mining, and/or helicopter-assisted skiing and hiking. Wilderness is a finite and ever-appreciating resource in today's world, and the special qualities of Alaska's wild lands are something it should hold in trust for future generations to enjoy, as I and many others have. The most crucial elements that elevate it above other places in "the lower 48" are the very lack of timber cutting, mining, helicopters and other motorized vehicles that this proposed plan threatens to introduce to the Nellie Juan College Fiord WSA. …
>
> *Comment: Discourse Quality = 2; Type = form letter, edited; From = individual*

Figure 4.4. Example of an argument using “illustration.” *Source:* Data from USFS 2018b.

Lower rater reliability scores here also reflect on the difficulty in consistently applying item weights due to deciphering when a comment was referencing policy actions for a group’s self-interests or for the greater common good. Here too, the original DQI coding parameters stated both implicit and explicit references were eligible for coding. Speech acts under this parameter could not be clearly delineated as to whether a policy should focus solely on group interests, or that focusing policy on group interests would benefit the common good. This is illustrated in Figure 4.5 and Figure 4.6. Yet despite this lower agreement range for these two items, the results still showed that the item constructs were appropriate for application to these spatial narratives, even if the items were detected in either in implicit or explicit forms.

> Thank you for the work you are doing. I would like to see expanded snow grooming for cross country skiing in "front country" areas. For many people who do not have the ability or interest to travel into back country areas during the winter this would provide an opertunity [*sic*] to engage with the forest during these months. This would be an activity that would have minimum or no dexter acne [*sic*] with other user groups. I would also like to see continued efforts to give people a chance to utilize the forest for low impact none motorized recreation in general. The forest around Turnigan [*sic*] pass may become one of the last places to ski in south central Alaska in the future and long-term planning should take the potential for concentrated non-motorized winter recreation into account.
>
> *Comment: Discourse Quality = 5; Type = original; From = individual*

Figure 4.5. Example of an argument using “*implicit* group justification.” *Source:* Data from USFS 2018b.

> To Whomever ... my wife and I experienced our first AK visit this past summer, along w/ other lower-48 friends on a repeat visit. We sailed w/ Capt. Dean Rand (Discovery Voyage) and witnessed the awe and beauty of Alaska's pristine wilderness.
>
> It was disheartening to see HOW MUCH human traffic (and climate) is washing away the awesomeness of Alaska's natural beauty.
>
> We very much want to return to repeat the breathtaking experience created by the Discovery Voyage crew ... but news of developing more tracts of wilderness ... or eliminating appropriate barriers that would allow unchecked development ... is disheartening. …
>
> *Comment: Discourse Quality = 3; Type = original; From = individual*

Figure 4.6. Example of an argument using “*explicit* group justification.” All ‘…’ except at the end of the comment are in the original. *Source:* Data from USFS 2018b.

The rater reliability statistics shown above focused on the index’s nominal dimensions, i.e. looking at the reliability of coding between sessions per nominal item and per each nominal item’s ordinal magnitudes. For the project, to judge that the modified DQI was applied consistently using only the nominal calculations was adequate. This was appropriate given that these calculations provide equally adequate evidence, at the detailed scale of per ordinal magnitude, to show that the modified DQI was applied consistently.

Such a focus on declaring reliability through nominal items was a departure from the original DQI's research, where reliability to the index's ordinal dimensions was also calculated. For ordinal scales of measurement, reliability is measured by finding the correlation of distributions between coding sessions using Spearman's 'rho' and Cronbach's 'alpha'. However, as stated in in the 'Methodology' Chapter, these statistics were used in a limited capacity for this project. There use was limited because knowing the correlation of ordinal magnitudes between coding sessions does not enhance the findings already achieved using RCA and 'kappa' calculations. As such, these ordinal dimension calculations performed confirmed what was already calculated -since the distribution of nominal magnitudes between coding sessions was consistent, the modified DQI was considered as have been applied to these public comments as the index was intended with qualitative deliberative data.

4.2.2. Index Item Correlation

To maintain methodological consistency with the original DQI, the index's item correlation was calculated as part of validating that the modified DQI was not only measuring discourse quality, but that the index's items, including the 'Spatial Precision' item were constructs relevant for quantifying qualitative spatial data. This calculation was essentially the deeper dive into the index's unidimensionality using the polychoric correlation coefficient to quantify how each of the six items in the index correlate to each other. Table 4.8 presents the results of coefficients calculated after the third recoding session, with greater than or equal to ±0.500 correlation coefficients italicized to highlight moderate correlations (Steenbergen et al.

2003; Urdan 2017). Plus, the interest is in correlation interactions across the multiple items, not just between pairs of them as the Pearson calculation only performs (Urdan 2017).

Table 4.8. Polychoric correlation scores, for 6-component DQI

Nominal Item		Correlated Item	Correlation Coefficient	p-values
Level of Justification	(L)	**L**	**1.000**	--
		C	-0.035	0.027
		R	-0.360	0.000
		CA	0.432	0.000
		P	-0.089	0.002
		S	-0.096	0.006
Content of Justification	(C)	L	-0.035	0.027
		C	**1.000**	--
		R	*0.546*	*0.491*
		CA	-0.328	0.009
		P	-0.096	0.000
		S	-0.477	0.025
Respect (for groups)	(R)	L	-0.360	0.000
		C	*0.546*	*0.491*
		R	**1.000**	--
		CA	*-0.631*	*0.002*
		P	0.042	0.001
		S	0.012	0.009
Respect for counterarguments	(CA)	L	0.432	0.000
		C	-0.328	0.009
		R	*-0.631*	*0.002*
		CA	**1.000**	--
		P	0.232	0.352
		S	*0.585*	*0.192*
Constructive Politics	(P)	L	-0.089	0.002
		C	-0.096	0.000
		R	0.042	0.001
		CA	0.232	0.352
		P	**1.000**	--
		S	*0.585*	*0.996*
Spatial Precision	(S)	L	-0.096	0.006
		C	-0.477	0.025
		R	0.012	0.009
		CA	*0.585*	*0.192*
		P	*0.585*	*0.996*
		S	**1.000**	--

Source: Results calculated with data from USFS 2018b.

These results show that some correlations were moderate, though they also lacked statistical significance. Moderate correlations of the index's other items to the 'Spatial Precision' item was also detected with not all of the index's items but only a select few. The lack of even moderate correlations across all the index's item suggested the modified DQI lacked unidimensionality. Lacking unidimensionality does not mean that the modified DQI was useless as a quantification measurement for qualitative data. Rather, the modified DQI was an appropriate method. The DQI was appropriate in that it contained grounded, communicative elements shown to be the most ideally needed for quality discourse (Jaramillo and Steiner 2014; Maia et al. 2017). Without the original DQI, there would have been a lack of context as to how speech acts influence the deliberative discourse in this qualitative dataset.

However, the results also suggest the modified DQI's, as assembled in this index, cannot directly measure the construct of discourse quality from deliberative, spatial data. This means that while the index's items were relevant to use in measuring discourse quality, the lack of unidimensionality showed that discourse quality in deliberative spatial data cannot be measured using the modified DQI. This finding does not discredit the DQI as a valid measure for discourse ethics, but that the DQI requires some further modification to generate more significant correlations, to further validate that the results' interpretations could be extrapolated beyond this sampled population.

And yet, the lack of unidimensionality may actually make sense for this dataset. Speech acts from the public are less likely to be concerned that all elements of "formal" discourse are used than those generated in formal, ritualized deliberative settings, where structured speech is more likely to be expected (Jaramillo and Steiner 2014; Maia et al. 2017; Wodak 2011). Under this premise, it is logical that this dataset does not have unidimensionality since the modified DQI's items did not generate normal distributions with the coding results.

Indeed, not having normal distributions of ordinal magnitudes across items is a major factor affecting correlation coefficients. Correlation coefficients operate on the assumption that any two or more data variables are normally distributed when compared against each other (Urdan 2017). Beyond then ritualized deliberative settings, it would seem implausible to see these DQI items be normally distributed. Even for this sample population, people are known to adapt their vernacular to meet their communication needs, which is dependent on who they are communicating with and for what purpose (Elwood 2006; Kyttä et al. 2013; Mitchell and Elwood 2012; Moore 2004). Thus, with such frequent language shifting, one would be less likely to detect the DQI's items in normal distributions. Plus, as had been found in other content analysis research, the public is not generally acclimated to using formal, deliberative elements frequently, a notion for which the DQI has been criticized (Jaramillo and Steiner 2014; Maia et al. 2017). For the project then, applying the modified DQI as it were may not actually be appropriate for analyzing speech acts direct from the public, even if the public is engaging in deliberative discourse.

The lack of unidimensionality with this modified DQI prompted a new question to consider regarding the 'Spatial Precision' item developed. The original DQI contains the items thought necessary to measure discourse quality. In its current combination, when applied to this project's dataset, the modified DQI generates a less-than valid measure of discourse quality. Does then the 'Spatial Precision' item share in some form of dimensionality that could be used, in another index form perhaps, to measure discourse quality? This was an important question to ask given that the lack of unidimensionality could be associated with the 'Spatial Precision' item, not that the original DQI in-of-itself was intrinsically inappropriate. Thus, while the polychoric correlation coefficients results give an indication as to which items would likely group together better to measure a concept similar or close to discourse quality, another index validity calculation was performed to verify if the ‘Spatial Precision’ item was likely to correlate at all with at least some of the other index’s items.

To answer this dimensionality question, a factor analysis was used to show how all of the index’s items may have any sort of correlating dimensional grouping. Using a correlation significance cutoff of less than ±0.30 to isolate which index items loaded along certain factor dimensions (Urdan 2017), this calculation showed some index items, both including and excluding the ‘Spatial Precision’ item, do factor load in groups with approximately two to three items per factor grouping. These results are presented in Table 4.9 are based on discourse quality values from the second coding session.

Table 4.9. Factor Analysis scores[a], per factor loading, per index item

	Factor Component		
Index Item	1	2	3
Level of Justification	-0.731	--	0.433
Content of Justification	0.752	--	--
Respect (for groups)	--[b]	0.785	--
Respect for Counterarguments	--	--	0.937
Constructive Politics	0.762	0.333	--
Spatial Precision	--	0.799	--

Source: Results calculated with data from USFS 2018b.
[a] Using oblique rotation.
[b] Factors not shown when less than ±0.30.

For instance, the factor analysis showed the ‘Spatial Precision’ item loaded with more confident correlation with the ‘Constructive Politics’ and ‘Respect’ items. In turn, the spatial item appeared to have weaker correlation, in both positive and negative directions respectively, with the ‘Content of Justification’ and the ‘Respect for Counterarguments’ items. With the

‘Level of Justification’ item, no significant correlation was detected between it and the spatial item. Taken together, these were encouraging findings. This suggested that not only were the public’s deliberative speech acts using at least some of the original DQI’s items, but that since the ‘Spatial Precision’ item did correlate with other items, the spatial item was not the sole source for the lack of unidimensionality for the entire modified DQI. Since this was an expected result given the polychoric coefficients, the factor analysis results are not presented here.

For the communicative element of spatial precision in deliberative discourse, the item correlation results suggest an intriguing finding. Some sort of interaction appears to occur between certain types of discourse elements. Yet the evidence to suggest though which elements interact, or whether the interaction was positive or negative for changes in discourse quality, still lacks confidence to state that those interactions between the spatial precision of narratives and the discourse elements used in the narratives were the result of spatial precision enhancing to detracting discourse quality.

4.2.3. Summary of the Statistics Results

The index reliability and validity calculation results suggest that the potential for these items’ interactions should not be disregarded. Having precise spatial landscape values in our discourse changes the quality of that discourse, though to what intensity or direction that change occurs remains uncertain. The modified DQI was appropriate for contextualizing and quantifying these public comments. However, the DQI was also limited in showing the significance as to how these communicative elements correlate. Nevertheless, though the index was more multidimensional than anticipated, these results showed that the generated discourse quality values can still provide a way forward to understand if spatial narratives change deliberative discourse quality. Since, albeit moderately, correlations between items were still detected, the index was still validated in its accuracy to capture the construct of discourse quality.

4.3. Discussion of Measured Discourse Quality

In some respects, the discourse quality values measured from the public comments and subsequent statistical reliability and validation calculations for the modified DQI can roughly explain for itself how the index quantified deliberative landscape valuations. However, the project was focused not just on showing the index's usability with qualitative spatial data, but on showing how deliberative discourse quality changed with spatial precision integrated into these public comment narratives. Thus, a subsection is needed to connect the results presented above to the project's research objectives.

This subsection then looks in two ways at interpreting the results to determine if discourse quality changed with precise spatial locations detected in the public comments. The first look was more binary, essentially concluding whether the overall discourse quality for the dataset changed or not. This was achieved by comparing discourse values when the dataset value with the spatial precision item was compared to the same dataset without the spatial item. The second look was for the degree to which precise spatial narratives changed discourse quality values. This was concerned with how the quality value shifted among the three magnitudes of spatial weights for the spatial item. These looks reflect on the dimensions of the index, incorporating its nominal aspects (whether spatial precision existed or not) and its ordinal aspects (the magnitude which the spatial precision was detected at).

4.3.1. Determining Overall Discourse Quality Change from Spatial Precision

Overall, public comments with the greatest magnitude for spatial precision detected were more likely to have greater discourse quality than comments that had less than the greatest spatial precision for landscape valuations, or simply had no spatial precision detected at all. This finding though is only applicable for the sampled population given the statistical reliability and validity calculations showed there is little probability the trends for discourse quality with the sampled population could be extrapolated to a wider population.

This finding for the sampled population is based on the direct comparison that the discourse quality values changed when classed by spatial precision magnitudes. This direct comparison involved looking at the class of discourse quality values with the greatest spatial precision and comparing it to the other classes which had less than the greatest spatial precision. The results showed that discourse quality for the class with the greatest spatial precision was greater than the other spatial precision classes as shown in Table 4.10.

Table 4.10. Deliberative discourse quality, for population sample, per spatial precision

Spatial Precision	N	Mean	Median	SD	Min	Max
Beyond Study Area	14	3.143	3.000	1.610	1.000	5.000
Study Area Only	8	4.875	5.000	1.458	3.000	7.000
Feature Within Study Area	129	5.791	6.000	1.379	3.000	13.000

Source: Results calculated with data from USFS 2018b.

However, this observation must be supplemented with additional calculations from a comparison of means test and observations from comparing the above class' standard deviations. This was needed because each ordinal weight class for the spatial precision item had different membership counts. This means the more members associated with a spatial weight, the more likely that that weight class would have a more normal distribution of its values than those with less members. While a lack of a normal distribution is not bad, inconsistent distributions between the spatial weights makes it impractical to compare directly quality change. For instance, since the spatial precision magnitudes for weights "0" and "1" were skewed in one direction, this may be so not because that was how the item was coded, but rather there were not enough members to produce a normal distribution. Thus, to more accurately show how discourse quality changes with added spatial precision, a comparison of means test was performed to show how statistically significant changes to discourse quality with and without the spatial item present. A direct comparison of the standard deviations between the spatial precision classes also contextualizes how precise landscape valuations helped maintain consistent level of discourse quality, further indicating that spatial precision appeared to help comments achieve greater discourse quality than without.

4.3.1.1. Comparison of means test

The comparison of means test used the Paired Samples *t* Test to generate a statistic for comparing how the spatial precision item contributed to the overall discourse quality value for the dataset. The Paired Samples *t* Test, as outlined in the 'Methodology' Chapter, generates a result if the spatial precision weight significantly contributed to discourse quality for the dataset overall. Significance was determined by calculating the probability that the spatial precision weight was more likely to add to discourse quality than if the dataset, without the spatial precision weight, were rearranged in random combinations to generate closer to similar discourse quality values. The results of the Paired Samples *t* Test are shown in Table 4.11.

Table 4.11. Comparison of means, for total index, with and without spatial precision item

Paired Samples[a]	Correlation[b]	Mean[b]	SD	95% CI[c]	t	df
w/ Spatial – w/o Spatial	0.926	1.762	0.608	1.664-1.859	35.614	150

Source: Results calculated with data from USFS 2018b.
[a] $n = 151$, per sample.
[b] $p < 0.001$.
[c] CI = Confidence Interval.

The Paired Samples *t* Test yielded encouraging results based on two indicators, as outlined by Kent State University Libraries (2018) and Urdan (2017). First, with strong and positive correlation ($r = 0.926$, $p < 0.001$) between the paired samples, the comparison of means result was interpreted in the sense that the spatial precision item was the predominate treatment in this test, which was further assumed to most influence change in discourse quality between the paired samples. In other words, the strong correlation between sets meant that this test had limited data noise from the index's other items that could also influence how discourse quality changes with or without the spatial item. Second, the mean difference between the paired samples was at a 95% confidence interval with a statistically significant p-value ($p < 0.001$). This suggested that under randomized conditions, the dataset without the spatial item was not likely to produce a similar discourse quality that could be had with the spatial item integrated.

Taken together, the comparison of means test showed that, on average, the total discourse quality value was 1.762 greater than the discourse quality value for a dataset without the 'Spatial Precision' item. Along with showing that the difference between these tested datasets was statistically significant, spatial precision in these public comments appeared to add to discourse quality overall. More importantly, for the project, this comparison helped show that landscape valuations could have its discourse quality changed when that discourse uses spatial precision in its narratives. Whether ultimately that change in discourse quality is for the better (in terms of influencing a public policy process), this finding cannot determine. What the finding does do is confirm that using a spatial precision construct, during the landscape valuation process appeared to alter how one communicates their landscape valuation.

The comparison of means test however only explained one aspect to how spatial precision changed discourse quality. Changes in quality values should also be explored by comparing the standard deviations between the spatial precision classes. This helps show that when there are tight ranges for the discourse quality values per class, quality changes between classes can be apricated for how consistently those values influence discourse quality.

4.3.1.2. Comparing spatial precision class standard deviations

Despite the unequal membership counts among the spatial weight rankings, looking at each weight class's standard deviation can show how quality changes were occurring based on the level of spatial precision coded. Standard deviation essentially shows how consistent the quality scores' variances were between the dataset's mean quality and the quality value calculated per comment.

As shown in Table 4.10 above, for the most precise spatial weight class, there was a standard deviation of 1.38, which means that comments with spatially precise locations produced a discourse quality with a consistently limited range variance. Such a limited standard deviation suggests spatial precision in comments keeps discourse quality at consistent levels, and for this case study area, at levels greater than those with less spatial precision. In other words, where there is spatial precision, deliberative discourse was likely to be greater in quality since spatial precision appears to keep discourse quality within a consistent quality range. This type of "high" discourse quality with the greatest amount of spatial precision detected is illustrated in Figure 4.7.

…The rules regarding motorized access in the Chugach have previously been pretty fair. One of the major issues that is unfair is Skookum/Placer River Drainage closing to motorized users in April. Due to the changing climate that area is rarely open as it is. When there is sufficient snow to protect the underlying vegetation it is unfair that the area is closed down to motorized users starting in April. I have been lucky enough to fly the area and drive past it numerous times after it closes and noticed that while the entire motorized community is closed out, very few non-motorized users are out enjoying the area. I'm sure dozens will come forth and say this isn't true, but regardless, it isn't fair. Motorized and non-motorized users need to share the back country when the snow is sufficient to protect the land. This area in question doesn't have a "corridor" that people use a trail. It is a wide-open valley with a million different ways in and out - therefore trail conflict is non-existent. Please consider opening this area beyond the current regulation so all Alaskans can access the back country - whether motorized or non-motorized. …

Comment: Discourse Quality = 8; Type = original; From = individual

Figure 4.7. Example of an argument showing “high precision spatial narrative” (with ordinal weight “2” for the spatial item). *Source:* Data from USFS 2018b.

Meanwhile, comments whose spatial precision were less than the highest-ranking weight showed standard deviations comparatively larger (1.46 with some spatial precision and 1.61 with no spatial precision). As before, these deviations suggest comments with less spatial precision produced wider variances of discourse quality. This means comments with less spatial precision are more likely to have wider ranges to discourse quality, and in this case have less quality than comments with greater spatial precision detected. These types of comments showing progressively less quality with progressively less spatial precision are illustrated in Figure 4.8.

I would like to offer my position that motorized access to the Chugach areas not be further restricted. Most areas within the Chugach are only accessible in the winter through the use of snowmobiles, and I have seen no evidence of damage to the ecosystem through their use. I continue to be an advocate of responsible use of these machines, respect to other users, and know that everyone else I ride with does the same. To restrict or eliminate this form of access is to essentially lock up these lands from access by citizens of this state. There is simply no other way to get into these areas, in a timely fashion, without dedicating days or weeks to snowshoeing or hiking back in. This is simply not feasible or practical for the majority of Alaskans.

To eliminate motorized access would do nothing to protect the Chugach, as there is no additional protection needed, in my opinion. …

Comment A: Discourse Quality = 7; Type = original; From = individual

Please leave the wilderness alone. Allowing development and activity are counterproductive to the goals of protection - which should be of paramount importance to your existence. …

Comment B: Discourse Quality = 5; Type = original; From = unknown

Figure 4.8. Examples of arguments showing an "accurate spatial narrative" (as with 'Comment A,' with ordinal weight "1" for the spatial item), and "no spatial precision narrative" (as with 'Comment B,' with ordinal weight "0" for the spatial item). *Source:* Data from USFS 2018b.

These examples show that when a public comment exhibited the greatest form of spatial precision, that comment was more likely to have less discourse quality variation than of those comments with less than the greatest form of spatial precision. In other words, spatially precise comments were not outlying occurrences (i.e., spatially precise comments existed only a fraction of a time within the sampled population). This is because the standard deviations shown in this type of comment exhibited little variation within the dataset, that comments with spatial precision tend to hold their quality throughout a sampled population, regardless of other parameters (e.g., comment origination or if it was an original thought). Comments that fall within a wider standard deviation arguably cannot maintain a consistent discourse quality, meaning that these were less likely to be spatially precise in their landscape valuations. Altogether, when a comment exhibited less than great spatial precision, the comment had a higher potential to not exhibit significant discourse quality change.

4.3.2. Detecting the Degree of Change to Discourse with Spatial Precision

While detecting discourse quality changes overall for the entire public comment dataset was achievable, detecting the magnitudes by which discourse quality changes from one level to another was not possible. The modified DQI's ordinal dimensions cannot logically be interpreted as having values which fall along an interval scale, where the amount of change from one value to another is known because all values on an interval scale are standardized with units to measure changes between values (e.g., to go from one inch to one-and-a-half inches, you must have traveled half-of-an-inch). Ordinal rankings inherently lack the properties to detect changes along a standardize measuring scale, unlike interval scales which measure physical changes to the state of an object like measuring temperature or distance (O'Sullivan and Unwin 2010).

As such, looking at the magnitude of changes from one discourse level to the next using ranking does not make sense. While ranking comments on their summed ordinal values does show which comments appear to have greater quality than others, the project's objective was to detect the degree of discourse change when there was spatial precision in landscape valuations. Since the difference between an ordinal ranking of "1" and "2" is not "1" but rather a condition of categorical identification, the project cannot interpret changes to discourse quality by a specific, interval magnitude given the presence of a certain spatial precision. Rather, changes to discourse quality must be looked at broadly (i.e., the discourse quality for an entire sampled population) so as to show how certain ordinal categories correlate with other categories (O'Sullivan and Unwin 2010). This type of comparison should show how the presence of one magnitude could affect the presence of another, versus by determining how much one item could affect the presence of another item. For example, Figure 4.9 shows how even with greatest spatial precision detected, the presence of that magnitude cannot exert a degree of influence over a comment's discourse quality, but only correlate with it.

I am concerned with currently human powered areas of the NF being zoned motorized. I do agree that there should be an equal amount of space available for every user group, but the areas that are more accessible for human powered travel should remain closed to motorized traffic. The motorized users can access terrain further from the roads, where the human powered personnel have a greater difficulty getting to, and it makes sense to use specific corridors to allow them access to those areas. In an effort to keep certain areas more peaceful, which many human powered users seek, the current boundary (East/West of Seward Hwy) in Turnagain Pass does a fairly good job keeping the East side of the pass quieter and safer for the people who choose to recreate there. Thank you for reading this very short concern.

Comment A: Discourse Quality = 8; Type = original; From = individual

The original Wilderness Study Area should remain a Wilderness. It is a unique opportunity to set aside a prestine [*sic*]area for future generations. Think how much good came from other wilderness areas which in the long run is much more beneficial to the general population than opening it up to development etc. which would only be to a few.…

Comment B: Discourse Quality = 6; Type = original; From = individual

The 1.9 million eligible acres of the WSA and surrounding roadless lands eligible for wilderness designation as Wilderness. Do not abandon protection for the nearly 600,000 acres you propose to eliminate from the WSA.

Comment C: Discourse Quality = 4; Type = original; From = unknown

Figure 4.9. Examples of arguments with progressively lower discourse quality, despite all having the greatest spatial precision (with ordinal weight “2” for the spatial item). *Source:* Data from USFS 2018b.

Unfortunately, the original DQI research was not clear as to if the DQI item weights should be considered in either the following ways, either along a scale where the difference between each magnitude is known or -if the magnitudes are only to be ordered and the difference between each order is unknown. Though the use of the Spearmen ‘rho’ in the original DQI research suggests the DQI’s weights should be interpreted as ordinal ranks, almost any construct involving the measurement of quality could lend their weighting schema to be interpreted along interval scales as well. For example, the “quality” of a phenomenon could be measured not only in terms of best to worst (i.e. ranking), but by the state of its existence (e.g., the quality of a bank account based on its daily financial balance, or the quality of one’s health given their internal temperature, both of which are instances measured on interval scale) (O'Sullivan and Unwin 2010).

However, discourse quality here it seems was conceptualized by in the original DQI research to be measured using ordinal (ranking) scales. This is perhaps on the basis that since discourse can occur through various mediums (e.g. writing, graphic visualization, video media), the ordinal scale is utilitarian enough to capture quality by ranking it, rather than devising an interval measure that would fit the mediums which discourse can exist. Thus, the ordinal dimension of the modified DQI limits the analysis to identifying discourse quality changes not for its degree of change between levels.

Chapter 5 Conclusion

The preceding statistical results and discussion provided a thorough overview of the sampled population's overall discourse quality value for their landscape valuations of the study area. However, the interpretation as to the trends in spatial precision shaping discourse quality for people in general would be only applicable to the discourse quality trends measured in the sampled population. This is due to the statistical calculations yielding probability values that could not meet thresholds, to state with surety, that the observed patterns of interactions between discourse items here could likely be observed beyond the sampled population (Steenbergen et al. 2003; Urdan 2017). Nevertheless, the project's analysis still yielded insights that are worth further investigation, in both terms of understanding how spatial precision in our speech could influence our discourse and how this project's methods could be adapted for other qualitative spatial science research. This Chapter provides an overview as to whether the above results and discussion helped to answer the project's research questions and hypothesis. There are also discussions on the areas in which this project could improve and where future qualitative spatial data research could be directed.

5.1. Answering Research Questions

Research questions provide expectations as to what type of results can be achieved with the methods devised. Research questions also help determine if the methods devised were appropriate for the data being worked with. Addressing a research question does differ from answering a hypothesis. The hypothesis is considered the overarching research objective which a project wants to answer with data, whereas research questions constitute the concrete analysis steps (objectives) that would be needed to help answer the hypothesis (Montello and Sutton 2013; O'Sullivan and Unwin 2010). For the project, the research questions validate that the analytical processes with the data helped answer the questions needed to get at the hypothesis. Revisiting these questions also helps understand what parts of the methodology, or the dataset, should be reassessed for future research.

The first of the four research questions asked if location precision in speech changes the quality of deliberative discourse. Given the analysis generated findings that showed discourse did appear to change along its nominal dimensions when the greatest magnitude of spatial precision was detected, the project considered this question partially answered. This is partial since the degree of discourse change cannot be known given the DQI's inherent ordinal measurement methods, and only shows in binary terms that discourse quality overall changed with spatial precision. This limits the understanding as to how spatial precision in speech influences other discourse elements. Nevertheless, with the methodology devised for the DQI to include spatial precision classes, having this research question partially answered illuminates how locations documented qualitatively can be useful within spatial science research.

The second research question asked whether the DQI could measure spatial precision in spatial narratives. This was partially answered given how the spatial precision item construct integrated with the modified DQI and was then applied during the coding sessions. On the whole, the factor analysis and strong rater reliability statistical calculations showed that the added spatial item for the construct of spatial precision could be detected and coded in qualitative spatial data consistently and objectively. However, the item correlation calculations also showed that the overall index for the case study area lacked unidimensionality across all the items. Factor analysis here too though showed the lack of unidimensionality meant instead some discourse items were more likely to be found correlating moderately together in two or three item groupings. This grouping of discourse items meant that the public comments from the CNF exhibited a more multidimensional formation of deliberative discourse than what the original DQI was designed to measure. Therefore, while spatial precision could be detected using the original DQI's content analysis methods, the project cannot say with surety that spatial precision could be consistently measured from all types of narratives beyond the CNF. This is so given the spatial construct was moderately correlated only with the original DQI's construct items, which generates doubt as to if the spatial precision detected was a phenomenon for only the case study area or otherwise.

The third research question asked if spatial narratives can be quantified from qualitative spatial data. Assuming that qualitative data contains narratives for quantitative analysis, the project considers this answered. Of course, to have narratives pulled from qualitative data, this requires an appropriate instrument to help decide on what elements within a dataset should be focused on for analysis. Since then the modified DQI instrument helped decide on which deliberative discourse elements should be focused on for this project's analysis, one should see that qualitative data contains narrative elements that are quantifiable.

Finally, the fourth research question asked how precise spatial narratives changed the quality of deliberative discourse. In reference to the factor loading analysis, the project stipulated in more Boolean terms which discourse components change with precise spatial narratives. Beyond this nominal finding though, the nuance as to how much the spatial precision influences other items could not be answered, due to the ordinal nature of the index's magnitude measuring.

5.2. Areas for Project Improvement

There are two areas of this project which would benefit from improved methods or reframing. Indeed, these two areas should be reevaluated before attempting to replicate the above methods using the same dataset or undertake similar research with another qualitative spatial dataset. Both of these areas address concerns with the structure of index instrument itself.

First, given the potential for speech acts beyond formal deliberative settings (e.g., a parliament) to have inconsistent use of discourse items, as illustrated in Figure 5.1 by the skewed distributions of the index's items' magnitudes detected in the analysis, the index may have limited application with other types of deliberative discourse. In the original DQI's research, the researchers had used a deliberative discourse dataset from a parliamentary debate. Arguably, a 'formal deliberative setting' requires more ritualized deliberative communication elements (see Elwood and Leszczynski 2013; Maia et al. 2017) than would be known by a public submitting comments for a policy revision. With a formalized discourse setting, this may have allowed for the index's items in the original research to be detected with normal distributions across all the DQI's items. In turn, when all of an index's items have normal distributions, unidimensionality of the index appears reinforced (Rigdon 2010; Urdan 2017). If then the index's validity is reliant on having unidimensionality for measuring the overarching construct of deliberative discourse, then the index may appear to fall apart when deliberation is researched beyond formalized discourse settings. Thus, while the elements of the index are still valid and well grounded, use of the DQI, original or as modified in this project, outside of more formalized discourse settings should proceed with caution.

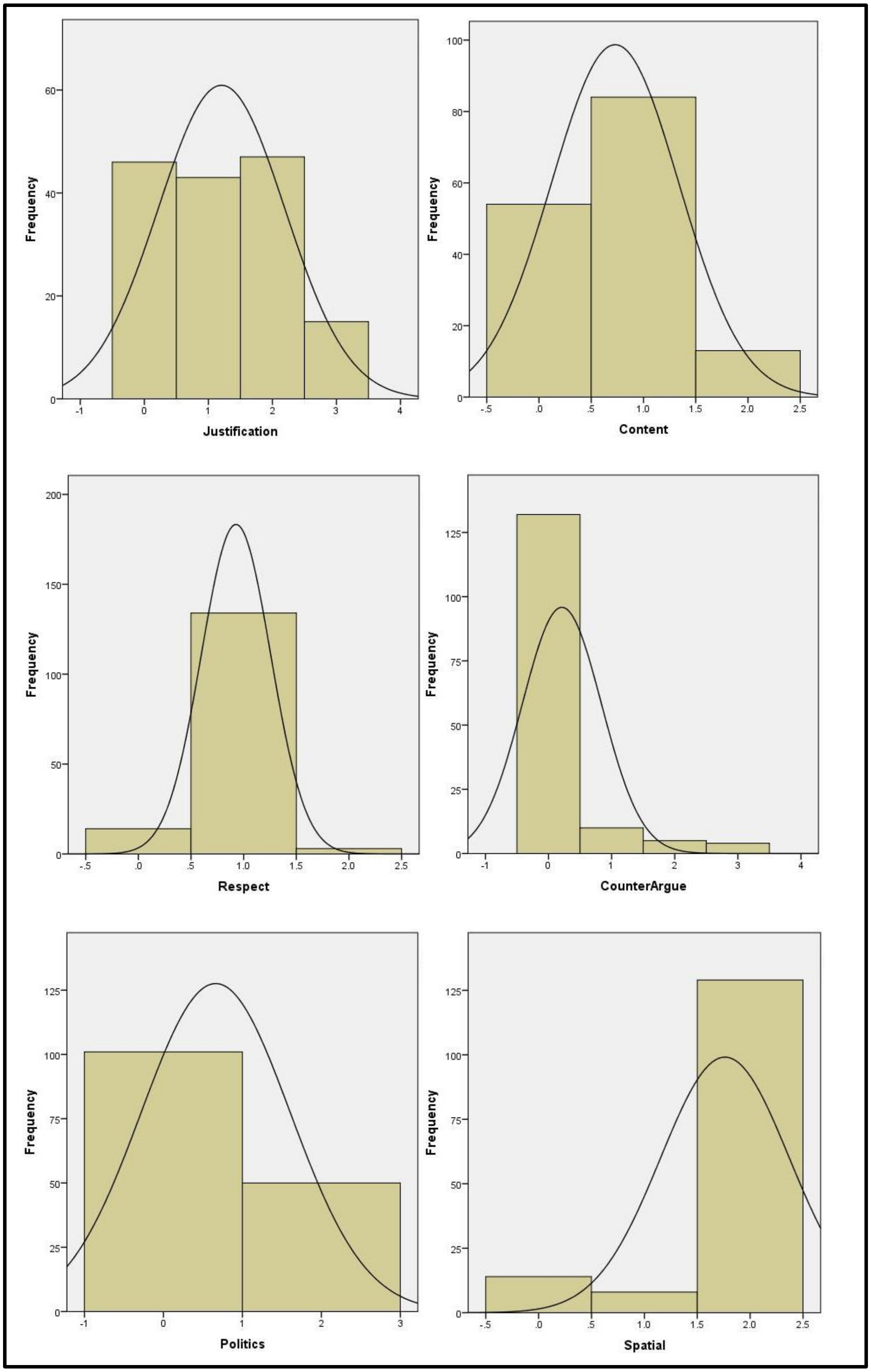


Figure 5.1. Distribution of the index's ordinal weights, per nominal item. *Source:* Results calculated with data from USFS 2018b.

Second, the parameter from the original DQI that some items could be detected and coded under both implicit and explicit contexts introduced significance doubt during the content analysis process. Indeed, human communication strategies contains a massive range of expressive abilities, both through direct language and subtle non-verbal ques (Jaramillo and Steiner 2014; Maia et al. 2017; Moore 2004). As such, an index designed to quantify human speech through transcripts or written words (i.e., public comments) should recognize that capturing both implicit and explicit forms of communicative elements here is practically impossible and gives a false-positive as to what a communicative item's presence is in a speech act. In other words, allowing both implicit and explicit communicative forms could make it difficult to isolate the influences one discourse item may have on another in the index. Any index then quantifying human language should accommodate those range of abilities in speech by delimiting itself to accept either implicit or explicit forms of language.

This struggle with coding implicit and explicit forms of language was especially seen with the index items 'Level of Justification' and 'Content of Justification'. Under an assumption of mutual exclusivity, explicit illustrative justifications, or mentions of group interest, for example should be weighed as having less quality than justifications with explicit reasoning, mentions for the common good, as outlined in the DQI's coding parameters. And yet, implicit illustrative justifications and group interest could suggest that such reasoning is just as valuable as the more explicit versions. Thus, the allowance of either implicit or explicit reasoning seems to contradict which type of reasoning is more valuable to discourse quality. To use the DQI, original or otherwise, on another qualitative spatial dataset, one may wish to further reduce ontological uncertainty during content analysis by grounding which forms of implicit or explicit discourse should be quantified.

5.3. Future Directions

This project has created a bridge between spatial science and other disciplines. This bridge hopefully spurs further research by setting the precedent for the spatial sciences to create new constructs and models of spatial relationships as conceived by other disciplines, disciplines that would not have spatial analysis tools. Essentially, this project hopefully inspires spatial scientists to explore new ways of conceptualizing and analyzing spatial relationships.

With respect to the future, there are three areas in which researchers could further build upon the findings. First, a before-and-after comparison of public policies that undergo a policy revision process with public comments could occur to validate the dimensions by which spatial precision narratives may influence a policy. Unfortunately, such comparisons prove challenging as some policy revision processes take almost a decade, and by then the nature of influence over a revised policy may well be forgotten or minimized (Brown and Donovan 2013; Kahila-Tani et al. 2015). Second, the analysis included form letters from the public, which were assumed to represent their perspective during deliberative discourse. As such, the implications on discourse quality between submitting a form letter versus submitting original thoughts were not explored in-depth. Investigations then into if discourse quality should be considered reduced when people use form letters instead of composing original comments could help understand how "templated" forms of discourse influence policy changes.

Finally, a larger question asked within softGIS research is to what extent participatory mapping activities help to empower communities when they leverage spatial narratives into knowledge politics (see Elwood and Leszczynski 2013; Perkins 2010). This is an important question for softGIS since political capital by means of "claiming" geographic knowledge over an area is a promise implied to a public who contribute their landscape valuations through softGIS activities, that their deliberative spatial discourse will influence policy changes (Kahila and Kyttä 2009; Kar et al. 2016). Yet the degree to which the public is empowered by softGIS remains unanswered.

This analysis provides a cornerstone for ongoing investigations and discussion on what spatial precision does for deliberative discourse. The research here offers glimpses into the type of information that qualitative spatial data can deliver, and up to this point had been largely unexplored. But further research is needed to build on the project's findings. And despite having areas for improvement, this project uncovered the possibilities to which spatial thinking affects our discourse during policy processes.

As governments strive to craft policies reflective of the people impacted by them, and people continue to find better ways to communicate landscape values to their governments, this analysis bore at least moderate evidence to suggest that what people choose to include as part of their arguments for policy changes matters. More importantly, this project showed that including spatial thinking into our discourse shapes the way people communicate their landscape values, and that spatial thinking is indeed an influential communicative tool.

References

Albright, Elizabeth A. 2018. “Inference: Comparison of Means.” *Nicholas School of the Environment, Duke University*. Accessed December 16, 2018. https://sites.nicholas.duke.edu/statsreview/means/.

Anderson, Monica. 2017. “Digital divide persists even as lower-income Americans make gains in tech adoption.” *Pew Research Center*, March 22. Accessed July 22, 2018. http://www.pewresearch.org/fact-tank/2017/03/22/digital-divide-persists-even-as-lower-income-americans-make-gains-in-tech-adoption.

Arnstein, Sherry R. 1969. “A ladder of citizen participation.” *Journal of the American Institute of Planners* 35, no. 4 (July): 216–24. doi: 10.1080/01944366908977225.

Bächtiger, André, Simon Niemeyer, Michael Neblo, Marco R. Steenbergen, and Jürg Steiner. 2010. "Disentangling diversity in deliberative democracy: Competing theories, their blind spots and complementarities." *Journal of Political Philosophy* 18, no. 1 (March): 32-63. doi: 10.1111/j.1467-9760.2009.00342.x.

Bhattacherjee, Anol. 2012. *Social Science Research: Principles, Methods, and Practices*. 2nd ed. University of South Florida, Tampa: Global Text Project. url: https://scholarcommons.usf.edu/oa_textbooks/3/.

Birkland, Thomas A. 2005. *An Introduction to the Policy Process.* New York: M.E. Sharpe.

Bolstad, Paul. 2016. *GIS Fundamentals: A First Text on Geographic Information Systems*. Minnesota: Eider Press.

Brown, Greg. 2012. "An Empirical Evaluation of the Spatial Accuracy of Public Participation GIS (PPGIS) Data." *Applied Geography* 34 (May): 289-94. doi: 10.1016/j.apgeog.2011.12.004.

Brown, Greg, Christopher M. Raymond, and Jonathan Corcoran. 2015. “Mapping and measuring place attachment.” *Applied Geography* 57 (February): 42-53. doi: 10.1016/j.apgeog.2014.12.011.

Brown, Greg G., and David V. Pullar. 2012. "An Evaluation of the Use of Points versus Polygons in Public Participation Geographic Information Systems Using Quasi-experimental Design and Monte Carlo Simulation." *International Journal of Geographical Information Science* 26, no. 2 (February): 231-46. doi: 10.1080/13658816.2011.585139.

Brown, Gregory Gordon, and Pat Reed. 2012. Social landscape metrics: measures for understanding place values from public participation geographic information systems (PPGIS). *Landscape Research* 37, no. 1 (February): 73-90. doi: 10.1080/01426397.2011.591487.

Brown, Gregory, and Delene Weber. 2012. "Measuring Change in Place Values Using Public Participation GIS (PPGIS)." *Applied Geography* 34 (May): 316-324. doi: 10.1016/j.apgeog.2011.12.007.

Brown, Greg, Delene Weber, and Kelly de Bie. 2014. "Assessing the Value of Public Lands Using Public Participation GIS (PPGIS) and Social Landscape Metrics." *Applied Geography* 53 (September): 77-89. doi: 10.1016/j.apgeog.2014.06.006.

Brown, Greg, and Marketta Kyttä. 2014. "Key Issues and Research Priorities for Public Participation GIS (PPGIS): A Synthesis Based on Empirical Research." *Applied Geography* 46 (January): 122-36. doi: 10.1016/j.apgeog.2013.11.004.

——. 2018. "Key issues and priorities in participatory mapping: Toward integration or increased specialization?" *Applied Geography* 95 (April): 1-8. doi: 10.1016/j.apgeog.2018.04.002.

Brown, Gregory, and Patrick Reed. 2000. "Validation of a Forest Values Typology for Use in National Forest Planning." *Forest Science* 46, no. 2 (May): 240–7. doi: 10.1093/forestscience/46.2.240.

Brown, Gregory, and Shannon Donovan. 2013. "Escaping the National Forest Planning Quagmire: Using Public Participation GIS to Assess Acceptable National Forest Use." *Journal of Forestry* 111, no. 2 (March): 115-25. doi: 10.5849/jof.12-087.

Cerveny, Lee, Kelly Biedenweg, and Rebecca Mclain. 2017. "Mapping Meaningful Places on Washington's Olympic Peninsula: Toward a Deeper Understanding of Landscape Values." *Environmental Management* 60, no. 4 (June): 643-64. doi: 10.1007/s00267-017-0900-x.

Dorling, Daniel. 2010. *Injustice: Why Social Inequality Persists.* Portland, OR: Policy Press.

Downs, Rodger M., 1997. "The geographic eye: Seeing through GIS?" *Transactions in GIS* 2, no.2 (November): 111-121. doi: 10.1111/j.1467-9671.1997.tb00019.x.

Elwood, Sarah. 2006. "Beyond Cooptation or Resistance: Urban Spatial Politics, Community Organizations, and GIS-Based Spatial Narratives." *Annals of the Association of American Geographers* 96, no. 2 (June): 323-41. doi: 10.1111/j.1467-8306.2006.00480.x.

Elwood, Sarah, and Agnieszka Leszczynski. 2013. "New Spatial Media, New Knowledge Politics." *Transactions of the Institute of British Geographers* 38, no. 4 (August): 544-59. doi: 10.1111/j.1475-5661.2012.00543.x.

Engen, Sigrid, Claire Runge, Greg Brown, Per Fauchald, Lennart Nilsen, and Vera Hausner. 2018. “Assessing local acceptance of protected area management using public participation GIS (PPGIS).” *Journal for Nature Conservation* 43 (June): 27-34. doi: 10.1016/j.jnc.2017.12.002.

Ernoul, Lisa, Angela Wardell-Johnson, Loïc Willm, Arnaud Béchet, Olivier Boutron, Raphaël Mathevet, Stephan Arnassant, and Alain Sandoz. 2018. "Participatory Mapping: Exploring Landscape Values Associated with an Iconic Species." *Applied Geography* 95 (June): 71-8. doi: 10.1016/j.apgeog.2018.04.013.

Fu, Pinde, and Jiulin Sun. 2011. *Web GIS: Principles and Applications*. Redlands, CA: ESRI Press.

FRS (Federal Reserve System) and Brookings Institution. 2008. *The enduring challenge of concentrated poverty in America: Case studies from communities across the U.S.* ISBN 978-0-615-25428-9. Federal Reserve System and Brookings Institution Metropolitan Policy Program.

Gaventa, John. 2006. “Finding the Spaces for Change: A Power Analysis.” *IDS Bulletin* 37, no. 6 (November): 23-33. doi: 10.1111/j.1759-5436.2006.tb00320.x.

Goodchild, Michael F. 1992. “Geographical information science.” *International Journal of Geographical Information Systems* 6, no. 1 (January): 31-45. doi: 10.1080/02693799208901893.

Hammersley, Martyn. 2011. “Conversation Analysis and Discourse Analysis: Self-Sufficient Paradigms?” In *Questioning Qualitative Inquiry*, 101-127. London: SAGE Publications. doi: 10.4135/9780857024565.

Hepburn, Alexa, and Jonathan Potter. 2011. “Discourse Analytic Practice.” In *Qualitative Research Practice*, 168-185. London: SAGE Publications. doi: 10.4135/9781848608191.

Jaramillo, Maria, and Jürg Steiner. 2014. "Deliberative Transformative Moments: A New Concept as Amendment to the Discourse Quality Index." *Journal of Public Deliberation* 10, no. 2: 1-22. URL: http://www.publicdeliberation.net/jpd/vol10/iss2/art8.

Kahila, Maarit, and Marketta Kyttä. 2009. “SoftGIS as a Bridge-Builder in Collaborative Urban Planning.” In *Planning Support Systems Best Practice and New Methods*, edited by Stan Geertman and John Stillwell, 389-411. New York: Springer.

Kahila-Tani, Maarit, Anna Broberg, Marketta Kyttä, and Taylor Tyger. 2015. "Let the Citizens Map—Public Participation GIS as a Planning Support System in the Helsinki Master Plan Process." *Planning Practice & Research* 31, no. 2 (December): 195-214. doi: 10.1080/02697459.2015.1104203.

Kar, Bandana, Renee Sieber, Muki Haklay, and Rina Ghose. 2016. "Public Participation GIS and Participatory GIS in the Era of GeoWeb." *Cartographic Journal* 53, no. 4 (November): 296-9. doi: 10.1080/00087041.2016.1256963.

Kent State University Libraries. 2018. “SPSS Tutorials: Paired Samples t Test.” *Kent State University*, November 7. Accessed December 16, 2018. https://libguides.library.kent.edu/SPSS/PairedSamplestTest.

Kyttä, Marketta, Anna Broberg, Tuija Tzoulas, and Kristoffer Snabb. 2013. "Towards Contextually Sensitive Urban Densification: Location-based SoftGIS Knowledge Revealing Perceived Residential Environmental Quality." *Landscape and Urban Planning* 113 (May): 30-46. doi: 10.1016/j.landurbplan.2013.01.008.

Lopes-Aparicio, Susana, Matthias Vogt, Philipp Schneider, Maarit Kahila-Tani, and Anna Broberg. 2017. "Public Participation GIS for Improving Wood Burning Emissions from Residential Heating and Urban Environmental Management." *Journal of Environmental Management* 191, no. C (April): 179-88. doi: 10.1016/j.jenvman.2017.01.018.

Maia, Rousiley C. M., Danila Cal, Janine K. R. Bargas, Vanessa V. Oliveira, Patrícia G. C. Rossini, and Rafael C. Sampaio. 2017 "Authority and Deliberative Moments: Assessing Equality and Inequality in Deeply Divided Groups," *Journal of Public Deliberation* 13, no. 2 (November). URL: https://www.publicdeliberation.net/jpd/vol13/iss2/art7.

McHugh, Rosemarie, Stéphane Roche, and Yvan Bédard. 2009. "Towards a SOLAP-based Public Participation GIS." *Journal of Environmental Management* 90, no. 6 (May): 2041-054. doi: 10.1016/j.jenvman.2008.01.020.

Mitchell, Katharyne, and Sarah Elwood. 2012. "From Redlining to Benevolent Societies: The Emancipatory Power of Spatial Thinking." *Theory and Research in Social Education* 40, no. 2 (April): 134-63. doi: 10.1080/00933104.2012.674867.

Montello, Daniel. R., and Paul C. Sutton. 2013. *An introduction to scientific research methods in geography and environmental studies*. 2nd ed. Los Angeles, CA: Sage.

Moore, Jerry D. 2004. *Visions of culture: An introduction to anthropological theories and theorists*. 2nd ed. Walnut Creek, CA: AltaMira Press.

NRC (National Research Council). 2006. *Learning to Think Spatially: GIS as a Support System in the K-12 Curriculum*. Washington, DC: The National Academies Press. doi: 10.17226/11019.

Nummi, Pilvi. 2018. "Crowdsourcing Local Knowledge with PPGIS and Social Media for Urban Planning to Reveal Intangible Cultural Heritage." *Urban Planning* 3, no. 1 (March): 100-115. doi: 10.17645/up.v3i1.1266.

O'Sullivan, David, D. and David J. Unwin. 2010. *Geographic information analysis 2nd ed.* Hoboken, N.J: John Wiley & Sons.

Perkins, Douglas D. 2010. "Empowerment." In *Political and Civic Leadership: A Reference Handbook*, edited by Richard A. Couto, 207-18. Thousand Oaks, CA: SAGE Publications.

Pietrzyk-Kaszyn´ska, Agata, Michał Czepkiewicz, and Jakub Kronenberg. 2017. “Eliciting non-monetary values of formal and informal urban green spaces using public participation GIS.” *Landscape and Urban Planning* 160 (January): 85-95. doi: 10.1016/j.landurbplan.2016.12.012.

Plantin, Jean-Christophe. 2014. *Participatory Mapping: New Data, New Cartography.* Focus Series, edited by Anne Ruas. Hoboken, N.J.: John Wiley & Sons.

PSU (Pennsylvania State University). 2018. “Comparing Two Population Means: Paired Data.” *Eberly College of Science, Applied Statistics*. Accessed December 16, 2018. https://onlinecourses.science.psu.edu/stat500/node/51/.

Ramasubramanian, Laxmi. 2010. *Geographic Information Science and Public Participation.* Advances in Geographic Information Science, edited by Shivanand Balram and Suzana Dragicevie. New York: Springer.

Rantanen, H., and M. Kahila. 2009. "The SoftGIS Approach to Local Knowledge." *Journal of Environmental Management* 90, no. 6 (May): 1981-990. doi: 10.1016/j.jenvman.2007.08.025.

Rigdon, Edward E. 2010. “Polychoric Correlation Coefficient.” In *the Encyclopedia of Research Design*, edited by Neil J. Salkind, 1046-8. Thousand Oaks, CA: SAGE Publications.

Rittel, Horst W. J., and Melvin M. Webber. 1973. “Dilemmas in a General Theory of Planning.” *Policy Sciences* 4 (June): 155-69. doi: 10.1007/bf01405730

Saldaña, Johnny. 2013. *The Coding Manual for Qualitative Researchers 2nd ed*. Thousand Oaks, CA: SAGE Publications.

Steenbergen, Marco R. 2000. “Item Similarity in Scale Analysis.” *Political Analysis* 8, no. 3 (March): 261-83. doi: 10.1093/oxfordjournals.pan.a029816.

Steenbergen, Marco R., André Bächtiger, Markus Spörndli, and Jürg Steiner. 2003. "Measuring Political Deliberation: A Discourse Quality Index." *Comparative European Politics* 1, no. 1 (March): 21-48. doi: 10.1057/palgrave.cep.6110002.

Sui, Daniel, Sarah Elwood, and Michael Goodchild, eds. 2013. *Crowdsourcing Geographic Knowledge: Volunteered Geographic Information (VGI) in Theory and Practice*. New York: Springer.

Trochim, William M.K. 2006. “Sampling.” In *Web Center for Social Research Methods*. Accessed July 22, 2018. http://www.socialresearchmethods.net/kb/sampling.php.

Urdan, Timothy C. 2017. *Statistics in Plain English 4th ed.* New York: Routledge.

US Department of Agriculture. Forest Service. 2016. *A Citizens’ Guide to National Forest Planning*, by the Federal Advisory Committee on Implementation of the 2012 Land Management Planning Rule. Washington, DC.

US Forest Service. 2014. “2014 Assessment Report: Chapter 1 Assessment Overview.” Chugach National Forest. Accessed July 22, 2018. https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprd3822692.pdf.

——. 2018a. “Chugach National Forest Geographic Information System.” Theme Index. Accessed November 4, 2018. https://data.fs.usda.gov/geodata/rastergateway/alaska/chugach/.

——. 2018b. “Revision of the Land Management Plan for the Chugach National Forest.” Reading room. Accessed July 7, 2018. https://cara.ecosystem-management.org/Public/ReadingRoom?project=40816.

Vich, Guillem, Oriol Marquet, and Carme Miralles-Guasch. 2018. "The Scales of the Metropolis: Exploring Cognitive Maps Using a Qualitative Approach Based on SoftGIS Software." *Geoforum* 88 (January): 49-56. doi: 10.1016/j.geoforum.2017.11.009.

Warner, Kee, and Harvey Molotch. 1995. "Power to Build: How Development Persists despite Local Controls." *Urban Affairs Quarterly* 30, no. 3 (January): 378-406. doi: 10.1177/107808749503000304.

Wodak, Ruth. 2011. “Critical Discourse Analysis.” In *Qualitative Research Practice,* edited by Clive Seale, Giampietro Gobo, Jaber F. Gubrium, and David Silverman, 186-201. London: SAGE Publications.

Wolf, Isabelle D., Greg Brown, and Teresa Wohlfart. 2017. "Applying Public Participation GIS (PPGIS) to Inform and Manage Visitor Conflict along Multi-use Trails." *Journal of Sustainable Tourism* 26, no. 3 (August): 470-95. doi: 10.1080/09669582.2017.1360315.

Wright, Dawn J., Michael F. Goodchild and James D. Proctor. 1997. “Demystifying the persistent ambiguity of GIS as ‘Tool’ versus ‘Science’” *Annals of the Association of American Geographers* 87, no. 2 (June): 346-62. doi: 10.1111/0004-5608.872057.

Ziegler, Matthias, and Dirk Hagemann. 2015. “Testing the Unidimensionality of Items.” *European Journal of Psychological Assessment* 31, no. 4 (October): 231-7. doi: 10.1027/1015-5759/a000309.

Zolkafli, Amirulikhsan, Greg Brown, and Yan Liu. 2017. “An Evaluation of the Capacity-building Effects of Participatory GIS (PGIS) for Public Participation in Land Use Planning.” *Planning Practice & Research* 32, no. 4 (May): 385-401. doi: 10.1080/02697459.2017.1329470.

Zuk, Miriam, Ariel H. Bierbaum, Karen Chapple, Karolina Gorska, Anastasia Loukaitou-Sideris, Paul Ong, and Trevor Thomas. 2015. *Gentrification, displacement and the role of public investment: A literature review*. Working Paper 2015-05. San Francisco: Federal Reserve Bank of San Francisco.

Appendix A Original DQI Item Overview Table

Table A.1. Original discourse quality index's seven nominal items and their ordinal weights

Nominal Index Item	Ordinal Constructs	Weight	Meaning of Weight
Participation[a]	Interruption of speaker	0	During the delivery of a speech act, a speaker is interrupted before completing an argument
	No interruptions to speaker	1	During the delivery of a speech act, a speaker is not interrupted, allowed to complete an argument
Level of Justification	None	0	Speaker states what should/not be done without reasoning to why
	Inferior	1	Speaker states what should/not be done, but reasoning to why has no linkage, or reasoning is based on illustrations
	Qualified	2	Speaker states what should/not be done and at least one reasoning to why has linkage
	Sophisticated	3	Speaker states what should/not be done and at least two reasonings to why have linkage
Content of Justification	For group interests	0	Speaker states argument to benefit one or more group interests
	Neutral	1	Speaker does not state argument to benefit a group interest nor for the 'common good'
	For common good, utility	2a[b]	Speaker states argument to benefit the 'greatest good for greatest number' (utilitarian terms)
	For common good, difference	2b[b]	Speaker states argument to benefit the 'least advantaged in society' (different principle)
Respect (for groups)	None	0	Speaker mentions only negative statements about groups participating or benefiting from deliberation
	Implicit	1	Speaker does not mention negative statements about groups participating or benefiting from deliberation, nor mentions explicit positive statements
	Explicit	2	Speaker mentions at least one positive statement about groups participating or benefiting from deliberation, regardless if there are negative statements as well

Source: Steenbergen et al. 2003

[a] Item not included in modified DQI. Project assumed if one submitted a comment, then the speaker was participating without interruption, which would have produced a constant (1.000). For statistical reliability calculations, constants would have been removed prior to calculations.

[b] Ordinal weight (2a) and (2b) having the same ranking weight, as creators of the DQI deemed these reasonings have the same impact to discourse yet should be delineated separately due to different reasonings applied.

Nominal Index Item	Ordinal Constructs	Weight	Meaning of Weight
Respect (for demands of others)[c]	None	0	Speaker explicitly states no respect for the demand to bring an issue up for deliberation
	Implicit	1	Speaker does not explicitly state respect or no respect for the demand to bring an issue up for deliberation
	Explicit	2	Speaker explicitly has at least one statement of respect for the demand to bring an issue up for deliberation, regardless if there are other negative statements as well
Respect for Counter-arguments	Ignored	0	Speaker flatly ignores counterarguments
	Degraded	1	Speaker acknowledges counterarguments, but also explicitly degrades it with a negative statement about the reasoning or other speaker presenting the counterargument
	Neutral	2	Speaker acknowledges counterarguments, but does not explicitly applies a negative or positive value to it
	Valued	3	Speaker acknowledges counterarguments and explicitly states it as having positive value to it
Constructive Politics	Positional	0	Speaker offers no opportunities for reconciliation or consensus building to an issue being deliberated
	Alternative	1	Speaker offers for reconciliation or consensus building, but the offer is for another issue not related to the one currently in deliberation
	Mediating	2	Speaker offers for reconciliation or consensus building to an issue being deliberated

Source: Steenbergen et al. 2003

[c] Item not included in modified DQI. Project assumed since a submitted comment was focused on issue, then the demand for the issue to be deliberated was already established, which would have produced a constant (1.000). For statistical reliability calculations, constants would have been removed prior to calculations.

Appendix B Table of Discourse Item Weights and Quality Value, per comment

Public Comment Document #	*Content Justification*	*Respect for Counter-arguments*	*Level of Justification*	*Constructive Politics*	*Respect for Groups*	*Spatial Precision*	**Discourse Quality Value**
D 89	0	0	1	0	1	2	**4**
D 90	1	0	2	2	1	2	**8**
D 91	1	0	0	0	1	2	**4**
D 92	2	0	1	0	1	2	**6**
D 93	1	0	0	0	1	2	**4**
D 94	1	0	2	0	1	2	**6**
D 95	2	0	3	0	2	2	**9**
D 96	1	0	0	0	1	2	**4**
D 97	0	0	2	0	1	2	**5**
D 98	1	0	0	0	1	2	**4**
D 99	1	3	3	2	1	2	**11**
D 100	0	0	1	0	0	0	**3**
D 101	2	0	2	0	1	2	**7**
D 102	0	0	2	0	1	2	**5**
D 103	0	0	2	0	1	2	**5**
D 104	1	0	3	0	1	2	**7**
D 105	0	2	3	0	1	2	**8**
D 106	1	0	1	0	1	1	**3**
D 107	0	0	1	0	1	1	**3**
D 108	1	0	1	0	0	2	**4**
D 109	0	0	1	0	1	2	**4**
D 110	0	0	2	0	1	2	**5**
D 111	1	0	3	2	1	2	**9**

Public Comment Document #	*Content Justification*	*Respect for Counter-arguments*	*Level of Justification*	*Constructive Politics*	*Respect for Groups*	*Spatial Precision*	**Discourse Quality Value**
D 112	1	0	1	0	1	2	**5**
D 113	0	0	2	0	1	2	**5**
D 114	1	3	3	2	2	2	**13**
D 115	2	0	1	0	1	2	**6**
D 116	1	0	0	2	1	2	**6**
D 117	0	0	1	0	1	2	**4**
D 118	0	1	1	0	1	2	**5**
D 119	0	0	2	0	1	2	**5**
D 120	0	0	2	0	1	2	**5**
D 121	0	0	2	0	1	2	**5**
D 122	0	0	2	0	1	2	**5**
D 123	0	0	2	0	1	2	**5**
D 124	0	0	2	0	1	2	**5**
D 125	0	0	2	0	1	2	**5**
D 126	0	0	2	0	1	2	**5**
D 127	0	0	2	0	1	2	**5**
D 128	0	0	2	0	1	2	**5**
D 129	0	0	2	0	1	2	**5**
D 130	0	0	2	0	1	2	**5**
D 131	0	0	2	0	1	2	**5**
D 132	0	0	2	0	1	2	**5**
D 133	0	0	2	0	1	2	**5**
D 134	0	0	2	0	1	2	**5**
D 135	0	0	2	0	1	2	**5**
D 136	0	0	2	0	1	2	**5**
D 137	0	0	2	0	1	2	**5**

Public Comment Document #	*Content Justification*	*Respect for Counter-arguments*	*Level of Justification*	*Constructive Politics*	*Respect for Groups*	*Spatial Precision*	**Discourse Quality Value**
D 138	0	0	2	0	1	2	**5**
D 139	0	0	2	0	1	2	**5**
D 140	0	0	2	0	1	2	**5**
D 141	0	0	2	0	1	2	**5**
D 142	1	0	0	2	1	2	**6**
D 143	1	0	3	0	1	2	**6**
D 144	1	0	1	2	1	2	**7**
D 145	1	0	1	2	1	2	**7**
D 146	0	0	0	2	1	2	**5**
D 147	1	1	0	0	1	0	**3**
D 148	1	0	0	2	1	2	**6**
D 149	0	0	3	0	1	2	**6**
D 150	1	0	1	0	0	2	**4**
D 151	1	0	0	0	1	2	**5**
D 152	0	0	1	0	0	0	**1**
D 153	1	0	1	0	1	2	**5**
D 154	1	0	0	2	1	2	**6**
D 155	0	0	2	0	0	2	**4**
D 156	0	1	3	0	0	1	**5**
D 157	1	1	2	0	0	2	**6**
D 158	1	0	1	0	1	2	**5**
D 159	1	0	0	0	1	2	**4**
D 160	1	0	1	0	1	2	**5**
D 161	1	0	0	2	1	2	**6**
D 162	1	0	1	0	1	2	**5**
D 163	1	0	0	2	1	2	**6**

Public Comment Document #	*Content Justification*	*Respect for Counter-arguments*	*Level of Justification*	*Constructive Politics*	*Respect for Groups*	*Spatial Precision*	**Discourse Quality Value**
D 164	1	0	0	2	1	2	**6**
D 165	1	0	1	0	1	2	**5**
D 166	1	0	1	2	1	2	**7**
D 167	1	0	0	2	1	2	**6**
D 168	1	0	1	0	1	2	**5**
D 169	1	0	0	2	1	2	**6**
D 170	1	0	0	2	1	2	**6**
D 171	1	0	0	0	1	2	**4**
D 172	1	2	1	0	1	0	**5**
D 173	1	0	2	0	1	2	**6**
D 174	1	0	0	2	1	2	**6**
D 175	1	0	1	0	1	2	**5**
D 176	2	0	1	0	1	2	**6**
D 177	1	0	0	2	1	2	**6**
D 178	1	0	0	2	1	2	**6**
D 179	1	0	0	2	1	2	**6**
D 180	1	0	0	2	1	2	**6**
D 181	1	0	0	2	1	2	**6**
D 182	0	0	1	2	1	2	**6**
D 183	1	0	0	2	1	2	**6**
D 184	1	0	1	2	1	2	**7**
D 185	1	0	1	0	1	0	**3**
D 186	1	0	0	2	1	2	**6**
D 187	2	1	2	0	0	0	**5**
D 188	1	0	1	0	1	2	**5**
D 189	1	0	0	2	1	2	**6**

Public Comment Document #	*Content Justification*	*Respect for Counter-arguments*	*Level of Justification*	*Constructive Politics*	*Respect for Groups*	*Spatial Precision*	**Discourse Quality Value**
D 190	1	0	0	2	1	2	**6**
D 191	1	0	0	2	1	2	**6**
D 192	1	0	0	2	1	2	**6**
D 193	1	0	1	2	1	2	**7**
D 194	1	0	1	2	1	2	**7**
D 195	1	0	1	2	1	2	**7**
D 196	1	0	0	2	1	2	**6**
D 197	0	0	0	0	1	0	**1**
D 198	1	0	1	2	1	2	**7**
D 199	1	0	0	0	1	0	**2**
D 200	1	0	1	2	1	2	**7**
D 201	1	0	0	2	1	2	**6**
D 202	1	0	0	2	1	2	**6**
D 203	0	1	0	0	0	0	**1**
D 204	0	0	1	2	1	2	**6**
D 205	1	0	0	2	1	2	**6**
D 206	1	0	0	2	1	2	**6**
D 207	1	0	0	0	1	2	**4**
D 208	2	1	1	0	0	2	**6**
D 209	2	1	1	0	1	0	**5**
D 210	1	0	1	0	1	0	**3**
D 211	0	0	2	0	1	1	**4**
D 212	1	0	1	2	1	2	**7**
D 213	1	0	0	2	1	2	**6**
D 214	1	0	0	2	1	2	**6**
D 215	1	0	0	2	1	2	**6**

Public Comment Document #	*Content Justification*	*Respect for Counter-arguments*	*Level of Justification*	*Constructive Politics*	*Respect for Groups*	*Spatial Precision*	**Discourse Quality Value**
D 216	1	0	0	0	1	0	**2**
D 217	1	0	0	2	1	2	**6**
D 218	1	0	1	0	1	2	**5**
D 219	2	0	2	0	1	0	**5**
D 220	0	0	2	0	1	2	**5**
D 221	0	3	2	0	1	2	**8**
D 222	2	0	1	2	0	0	**5**
D 223	2	0	1	0	1	2	**6**
D 224	0	2	3	0	1	1	**7**
D 225	2	1	2	0	0	1	**6**
D 226	2	0	2	2	0	2	**8**
D 227	0	0	3	0	1	1	**5**
D 228	0	0	3	0	1	2	**6**
D 229	1	0	2	0	1	2	**6**
D 230	1	0	2	0	1	2	**6**
D 231	1	2	3	0	1	2	**9**
D 232	1	0	2	0	1	2	**6**
D 233	1	0	2	0	1	2	**6**
D 234	1	0	2	0	1	2	**6**
D 235	0	1	3	0	0	2	**6**
D 236	0	3	3	0	2	2	**10**
D 237	1	0	1	0	1	2	**5**
D 238	0	0	0	0	1	2	**3**
D 239	0	2	2	0	1	1	**6**