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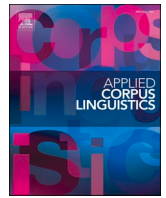
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Directives in COVID-19 government guidance: An international comparison

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ABSTRACT

The importance of language to changing public behaviours is acknowledged in crisis situations such as the COVID-19 pandemic. A key means of achieving these changes is through the use of directive speech acts, yet this area is currently under-researched. This study investigates the use of directives in the 2020 COVID-19 briefings of four leaders of English-speaking nations, Jacinda Adern, Boris Johnson, Scott Morrison, and Nicola Sturgeon. We developed a classification system including 16 directive types and used this to compare directive use across these four leaders, examining directness and forcefulness of directive use. The analysis finds Sturgeon to be the most prolific directive user and also to have the highest reliance on imperatives. Johnson, meanwhile, has a preference for directives involving modal verbs, particularly with first- and second-person pronouns. In contrast, Ardern and Morrison show a higher use of indirect directives, normally thought to be a less effective strategy. While Ardern often combines this strategy with judicious use of imperatives, this is not seen in Morrison's COVID-19 briefings. These findings tend to confirm earlier, more impressionistic evaluations of the communication styles of these leaders but also suggest other avenues for research on directive use. We conclude with implications for political crisis communication and analysis of directives in crisis communication.

1. Introduction

The sudden outbreak of COVID-19 in early 2020 presented governments around the world with the challenge not just of deciding the best course of action but also of communicating this effectively with the public (Finset et al., 2020). In such situations “the public expect the government to be a fast and reliable source of information” (UK Government Communication Service, 2021) and leaders need to “communicate clear consistent messages in an empathetic manner” (McGuire et al., 2020), “[a]cknowledging team effort... while also taking personal responsibility where appropriate” (S. Marsen and Ali-Chand, 2022). Numerous studies have shown that communication strategies can have a significant effect on public adoption of the behaviours governments wish to promote (e.g., Dada et al., 2021; Hansson, 2017; Lunn et al., 2020; McGuire et al., 2020). Language plays a vital part in “transforming political will into social action” (Partington and Taylor, 2018) and in managing crisis situations (Lunn et al., 2020; Marsen and Ali-Chand, 2022; Nielsen et al., 2020; Sanders, 2020). Of particular importance in this respect are directives, that is, “utterances designed to get someone to do something” (Goodwin, 2006). As Searle (1979) points out, directives may be framed in a range of different ways to show different

levels of directness and forcefulness, from inviting to insisting (see Section 2.1). Our interest is in how they have been used by political leaders in the context of instructions and recommendations during the COVID-19 pandemic.

An important way in which instructions and recommendations have been delivered during the pandemic is in press conferences and other public briefings. The application of corpus approaches to understanding how politicians communicate in such contexts is well-established (Ådel, 2010). In this study, we focus on four leaders of island nations on opposite sides of the world: Boris Johnson and Nicola Sturgeon in the UK, Jacinda Ardern in New Zealand and Scott Morrison in Australia. Reactions to crisis communication by these leaders have widely differed. Ardern has generally been praised (e.g., Dada et al., 2021; McGuire et al., 2020; Menon, 2020; Reyes Bernard et al., 2021). Johnson and his government, in contrast, have faced extensive criticism (e.g., Jones, 2021; Oliver, 2020; Sodha, 2020). The Australian Prime Minister (PM), Scott Morrison has also faced criticism for confusing messaging (Davey, 2020) and lack of empathy (Reyes Bernard et al., 2021). Less has been written about Sturgeon, but her people-orientated, empathetic approach is noted by Dada et al. (2021). These evaluations are particularly interesting when viewed against the greatly contrasting outcomes in

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these leaders' management of the pandemic. New Zealand and Australia were ranked the first and eighth most effective nations at managing the pandemic in 2020, while the UK came in 66th (Leng et al., 2021). It is interesting to consider the extent to which these outcomes might be associated with communication strategies.

While there is a long tradition of research on both political discourse and directives, the two have seldom been considered together, particularly in the context of crisis communication, as noted by Marsen & Ali-Chand (2022). This study compares the use of directives by Ardern, Johnson, Morrison, and Sturgeon using corpora of transcripts of COVID-19 briefings throughout 2020, to discover how they attempted to ensure compliance from the public with the measures they introduced. As Finset et al. (2020) point out, the way such recommendations are delivered is vital in ensuring compliance with measures designed to protect public health. Therefore, studying them is of interest to the communications teams supporting national and other leaders, who face the challenge of conveying the seriousness of crisis situations and motivating public action without unduly threatening their audience's face and thus risking noncompliance.

2. Literature review

2.1. Categorising directives: directness and forcefulness

As suggested in Section 1, directives encompass a range of more specific speech acts (e.g. request, invite, encourage, command) which can be realised using various linguistic devices (Searle 1979). The choices made are generally agreed to depend on contextual factors such as relationship between speaker and hearer (Brown and Levinson, 1987). Understanding how realisations differ and what this means can be achieved by considering directives in terms of directness and forcefulness.

Directness is the extent to which “people literally say what they mean” (Ervin-Tripp 1976; Searle 1979). A number of frameworks have been proposed that recognise different levels of directness, typically from Hint (entirely indirect) to the most direct form, the Imperative. One of the most influential of these is presented in Ervin-Tripp (1976); this framework was developed by House and Kasper (1981), who distinguish eight levels of directness (see Table 1) relating to realisations of requests. This framework is readily applicable to the wider category of directives. In the example provided by House and Kasper, someone asking (or directing) another person to open a window might vary the directness with which this request (or direction) is expressed from highly indirect (e.g., “it’s very cold in here” makes no reference to what should be done in response) to highly direct (e.g., “close the window”, which leaves the hearer in no doubt as to what they are being asked to do). Considering the level of directness is important because one can be clear by being direct, but being direct may impinge on matters of politeness (Ervin-Tripp, 1976; Searle, 1979; Weigel and Weigel, 1985) and threat to negative face, although in cases of urgency such considerations may be overridden (Brown and Levinson, 1987; Goodwin, 2006; Vine, 2009).

A dimension additional to directness that helps distinguish between realisations of directives relates to their forcefulness, “degree of intensity” (Searle, 1979) or “strength” (Sbisa, 2001). As well as making

choices over how direct to be, a speaker can vary the intensity of a directive even while retaining the same level of directness. It is generally considered more forceful, for example, to say *you must* than to utter *you should*. This dimension is well documented in the literature on modality, where it is related to “value” (e.g. Halliday and Matthiessen, 2014) or “strength” (Huddleston and Pullum, 2002) but it is not so commonly discussed in pragmatics. Vine (2009), for example, refers to the imperative as “the most forceful form” without distinguishing between types of imperative which could be used to alter this forcefulness (compare “close the window” and “let’s close the window”).

Politicians giving instructions can be seen as selecting from these options in relation to contextual factors, including the perceived urgency of the situation and the relationship they want to present as obtaining between themselves and their audience. An important question, therefore, is the extent to which choices of this sort are handled in leaders’ COVID-19 crisis communication.

2.2. COVID-19 and research on strategies in crisis communication

The COVID-19 pandemic has sparked great interest in crisis and risk communication, particularly around how behavioural change can be managed in similar crisis contexts. The realisation in early 2020 that the COVID-19 pandemic presented serious unprecedented challenges led to a number of position papers proposing how communication should be handled and suggesting areas of research that might inform more effective communication by leaders. Jaspal and Nerlich (2020) predicted some of the difficulties involved in governments seeking compliance to measures that potentially threaten individuals’ identities by changing their routines. They warned against emphasising negative emotions such as fear, instead proposing communication strategies that engage diverse groups and frame public health measures in more positive terms, such as team spirit. Lunn et al. (2020) likewise emphasised the importance of using inclusive language, making “clear statements of a desired collective behaviour”, and presenting such behaviour as benefiting all of society, a viewpoint shared by Finset et al. (2020).

One important area of research has looked at the crisis communication strategies of national leaders during the pandemic in speech events involving communication with the public (press conferences/briefings, speeches to parliament, statements to the nation, media releases). Research in this vein highlights aspects of this communication such as the extent to which leaders or groups of leaders (e.g. men vs. women – Dada et al., 2021) used particular strategies or mentioned specific topics.

One vital aspect of crisis communication mentioned in Section 1 is the clarity and consistency of messaging, and this focus is apparent in several studies of national leaders’ COVID-19 communication. In their study of Ardern’s interactions with the NZ public, McGuire et al. (2020) argue that she communicates “clearly and formally” (p. 368). Reyes Bernard et al. (2021) also describe Morrison as a clear communicator, although this claim seems inconsistent with the observation of Marsen and Ali-Chand (2022) that he is the “most indirect” (p.10) of the three leaders they study (Ardern, Morrison, and Bainimarama, the leader of Fiji). The UK government, and by implication Boris Johnson were found by Jones (2021), Nielsen et al. (2020) and Sanders (2020) to have created confusion through inconsistent messaging and thereby to have lost public trust. These findings are based mostly on content analysis not involving close linguistic analysis of speeches, such that a complete picture of the effectiveness of UK government messaging is does not emerge from this area of research. This shortcoming is also notable in the work of McGuire et al. (2020) and Reyes Bernard et al. (2021), both of whom claim that the leaders they analyse communicate clearly without defining what clarity might be, for example by equating it with simple language or a lack of jargon as McClaughlin et al. (2021) and Wolf (2011) do.

A further important finding from this group of studies concerns the discursive strategies used to encourage behaviour change. Leaders

Table 1
Levels of directness in requests (adapted from House and Kasper, 1981).

1. Mild Hint	<i>It's very cold in here</i>
2. Strong Hint	<i>Why is the window open?</i>
3. Query-Preparatory	<i>Can you close the window?</i>
4. State-Preparatory	<i>You can close the window</i>
5. Scope-Stating	<i>I would prefer it if you closed the window</i>
6. Locution-derivable	<i>You should close the window</i>
7. (a) Hedged-Performative	<i>I must ask you to close the window</i>
(b) Explicit-Performative	<i>I ask you to close the window</i>
8. Mood-derivable	<i>Close the window!</i>

commonly invoke ideas of social solidarity (Dada et al., 2021; McGuire et al., 2020), although not necessarily in the same way. Based on the analysis of 122 speeches given by 20 world leaders (half male, half female), Dada et al. (2021) found that male leaders focus more on war rhetoric, while women – including Jacinda Ardern and Nicola Sturgeon – favour a more compassionate approach based on empathy. As Dada et al. (2021) point out, “[w]hile war rhetoric plays to a collectivism based on fear and division, empathy appeals to a collectivism based on compassionate social cohesion” (p. 10). Ardern, in particular, is consistently praised for being sympathetic and approachable (McGuire et al., 2020; Marsen and Ali-Chand, 2022), while Reyes Bernard et al. (2021) point out that Morrison largely avoids expressing empathy.

Studies on strategies of crisis communication employed by national leaders in the pandemic have also noted the prominence of appeals to the public to follow health guidelines through an emphasis on what Dada et al. (2021) term “responsibility” and “paternalism”.¹ By “responsibility” Dada et al. (2021) mean that leaders “encourage individuals to act independently” while “paternalism” refers to “employ [ing] tactics such as shame, guilt, or punishment to influence the desired behaviour” (p. 7). They find that both of these rhetorical strategies were employed by most of the leaders of either gender in their study (including Ardern, Sturgeon and Johnson). Without using the same terms, similar concepts are referred to or exemplified in McGuire et al. (2020) and Marsen and Ali-Chand (2022). These strategies are of particular interest for the present study because they relate to instructions and how they are delivered, drawing attention to the importance of directives. However, the studies examined in this section do not generally identify which linguistic features are used to create the rhetorical effects they observe, even though the use of language seems key to the intended effect.

2.3. Studies on the linguistic aspects of COVID-19 crisis communication

As noted in the previous section, a series of studies on strategies of crisis communication in the COVID-19 pandemic has produced interesting results without generally focusing on specific linguistic features. The exception is Marsen and Ali-Chand (2022), whose study compares the use of speech acts in six key speeches given by the leaders of Australia, New Zealand and Fiji in the period of March-June 2020. Their focus on speech acts entails closer attention to language use and how it differs from leader to leader. As they point out, the “ways in which directives are framed indicate the relationship between interactants, matters of status and authority, and possible expectations of addressees” (Marsen and Ali-Chand, 2022). Directives were the most frequently occurring speech act in all three leaders’ communications, but they were used in different ways. Morrison is found to be the most indirect due in part to his use of hedging, while Ardern combines expressions of sympathy with directives which, Marsen and Ali-Chand argue, has the effect of reducing the force of the directives.

While these findings from Marsen and Ali-Chand (2022) are revealing, there are some aspects of their approach in need of adjustment for a study focusing on the linguistic realisations of directives. The first of these concerns how to deal with indirect speech acts. In seeking to avoid overlap between different speech acts, Marsen and Ali-Chand did not focus on indirect directives but classed utterances according to their face-value speech act. Taking this approach removes from the scope of investigation some instances of declaratives (e.g. reference to a

¹ See McClaughlin et al. (2023) in this issue for an interesting discussion of the impact of strategies such as these.

rule) and commissives (e.g. promises, warnings and threats)² which we would want to include. This approach also narrowed the set of forms counted as realising directives to imperatives, modals of obligation,³ and what Marsen and Ali-Chand refer to as “‘I want’ and ‘I ask’ statements”,⁴ although other forms are known to conventionally realise directive speech acts (see Section 3.2). A further aspect of directives not investigated by Marsen and Ali-Chand which seems important in the context of directives is the contrast between directness and forcefulness.

The final aspect of Marsen and Ali-Chand (2022) – and indeed all of the studies mentioned in Section 2 so far – that we feel could be built on is that they do not make use of corpus methods to arrive at, support or complement their findings.

There are, however, a number of studies which have adopted corpus approaches to study crisis communication during the pandemic. The crisis communication of Ardern and Morrison has already been examined in a corpus study by AUTHOR2 and AUTHOR3 (2022), who contrasted the keywords in each PM’s 2020 COVID briefings, to probe their discursive styles and examine the association between the styles of each PM and public perception of how well they managed the pandemic. Their findings give empirical linguistic support to earlier claims about Ardern’s interpersonal, empathetic approach, indicating the importance of the use of personal pronouns in clear communication, and in combination with *if*-clauses providing clear procedural instructions. Similarly, these findings support observations from others (e.g. Marsen and Ali-Chand, 2022) that Morrison uses language in ways that avoid taking responsibility for unpopular moves while simultaneously claiming credit for government decision-making.

Another study of interest is that reported by Williams and Wright (2020, J. 2022), who contrast the use of inclusive *we* – also termed “patriotic” *we* (Wales, 1996) – and exclusive *we* in Downing Street briefings from March-June 2020. Inclusive *we* refers to the speaker and their audience/interlocutors, while exclusive *we* refers to the speaker and other parties not present but excludes the audience. Williams and Wright found that government spokespeople tended to use exclusive *we* (i.e. where *we* did not include the general public) in constructions which acted to distance them from responsibility for key actions, something that did not apply in instances of inclusive *we*. This pattern included a number of instances where government spokespeople were uttering directives such as extract 1 (marked by *have to*).

- (1) *we have to take special steps to protect the particularly vulnerable*
(Johnson, 22 March 2020)

In this example, Williams and Wright (2020) argue, the key action referred to is to protect the vulnerable but the responsibility for doing so is subtly distanced from the government (*we*) to the *steps*. This study thus provides an interesting counterpoint to studies such as Marsen and Ali-Chand (2022) that assume *we* is straightforwardly a marker of unity/togetherness.

Another study benefiting from corpus techniques and focusing on Johnson’s COVID-19 communication strategies is McClaughlin et al. (2021), which examines speeches given between March 2020 and April 2021. This study also identifies the salience of *we* in the context of bringing people together, observing that the actions thereby referred to

² We would class instances of these speech acts that realise directives as Hints; a good example from Marsen & Ali-Chand (2022, p. 9) is the utterance ‘If people follow the government’s directives, we will lock this virus down’ which their categorisation labels a promise (‘commissive’) but which is additionally an indirect directive asking the public to follow the directives

³ Marsen & Ali-Chand’s term is “‘must’ and ‘need’ modals”; we have used here Biber et al.’s (1999) term as it is more widely known. The modals in question are *must*, *should*, *need (to)*, *ought* and *have to*

⁴ These seem to be what House & Kasper (1981) refer to as “performatives”, e.g. *I ask you to close the window* (see category 7 in Table 1).

are commonly quite vague. McClaughlin et al. (2021) note the co-occurrence of *we* with *must*, arguing that “Johnson’s instructions are presented as a collective obligation” (p. 4; distinction is not made between inclusive and exclusive *we*). They also point out the strategies of expressing gratitude to the public and showing empathy to support instruction giving, but criticise Johnson’s communication for its over-reliance on reference to personal responsibility, for the counter-productive use of war metaphors, for contradictory messaging, and for vagueness and for lack of concision.

Several key themes emerge from this review of research into national leaders’ COVID-19 crisis communication concerning the strategies they use to persuade the public to follow instructions. We have seen that much has been written about both the clarity and consistency of communication, identifying strategies such as appealing to social solidarity, showing empathy and taking or avoiding responsibility. However, there has been no systematic focus on one of the key means of persuasion, the ways directives are formulated. Yet greater understanding of this instruction giving aspect of crisis communication seems particularly important for understanding and potentially drawing lessons from different leaders’ individual styles and strategies.

3. Methodology

3.1. Data collection

Notwithstanding some notable differences in both their preferred channels of communication, all four of the leaders included in this study spoke publicly about COVID-19 throughout the first year of the pandemic, hosting press conferences and other official briefings, and making formal speeches designed to guide popular sense-making and behaviour. So as to compare only like genres, we retrieved from each leader’s official media relations website transcripts of every press conference and speech focusing on COVID-19 published between January and December 2020. In selecting this time frame, our aim was to map these leaders’ respective discursive approaches to containing the pandemic by guiding public behaviour before widespread vaccination became possible.

In collecting our corpus, we focused on the monologic segments of the briefings rather than including dialogic question-and-answer sessions which often followed them. One reason for focusing on monologic contexts is that most previous work on directives has focused on dialogic contexts (e.g. Bax, 1986; Curl and Drew, 2008; Ervin-Tripp, 1976; Weigel and Weigel, 1985). This focus was also partly determined on the grounds of consistency, since not all of the announcements were followed by dialogic question-and-answer sessions. A further factor in our decision was availability, since in most cases only the monologic parts of briefings were transcribed. We extracted from press conference transcripts only the official speeches or opening remarks made by each national leader. We also included COVID-19 focused speeches delivered outside press conference settings, such as Johnson’s lockdown announcement on 23 March 2020. Together, these press conference excerpts together with additional speeches (hereafter ‘briefings’) comprise our total corpus.

As shown in Table 2 below, the four leaders’ respective sub-corpora vary both in size and publication dates. Ardern and Morrison both commenced COVID-19 briefings more than a month before either Johnson or Sturgeon. Ardern also ceased publishing COVID-19 briefings around two months earlier than the other leaders, although she continued Facebook Live briefings until 21 December 2020. Sturgeon was by far the most prolific of the four and also averaged the highest number of words per briefing, which is why her sub-corpus is much larger than the others. Ardern had relatively few briefings because she varied her output, also running 115 Facebook Live sessions not included here as they were largely dialogic and not of a type with official briefings, being more informal in nature. Johnson’s low number of briefings, meanwhile, can be attributed partly to the decision by the UK

government to have a range of different speakers hold the Downing Street briefings (his contribution accounts for only 37 of the 119 briefings held in this period), a practice which resulted in some inconsistency in messaging (Oliver, 2020).

3.2. Data analysis and development of categorisation scheme

Once all of the briefing transcripts had been collected, they were uploaded to NVivo (QSR International, J. 2022) for annotation by the first two authors. Our initial coding framework drew on previous work on realisations of directives (Bax, 1986; Ervin-Tripp, 1976; House and Kasper, 1981; Searle, 1979; Weigel and Weigel, 1985). These frameworks are based on dialogic rather than monologic contexts. This meant that we did not find some realisation types in our corpus (e.g. House & Kasper’s “Scope-Stating” level in Table 1) and therefore omitted them. We also added other directive types which are rare in dialogic contexts but present in our corpus (e.g., Impersonal constructions; see Table 3).

In creating the framework and applying it to the annotation process, the first author was responsible for coding Johnson and Sturgeon’s briefings and the second author coded those delivered by Ardern and Morrison. We took several steps to ensure that this annotation would be as reliable as possible. First, the coding framework was co-developed by the first and second authors, who worked closely to ensure a shared understanding of both the focus and boundaries (inclusion / exclusion criteria) for each directive type. Second, we frequently discussed and reflected on the coding framework, iteratively and collaboratively updating it in response to the directives found in our corpus. Third, the first and second authors consulted regularly about any ambiguous or problematic instances in order to clarify interpretations and maximise consistency of coding across the entire corpus. Despite taking these steps, some minor inconsistencies emerged in the process of comparing results for this paper; these inconsistencies chiefly concern judgements about the directness of a small number of statements. An example of this is seen in (2), which appears to be self-directed yet lacks a specific addressee.

(2) *I think it is important to reiterate New Zealand has no officials in Wuhan, whereas the United States does.* (Ardern, 28 January)

We also expanded our initial coding framework to account for finer distinctions of directness and forcefulness of directives than are usually included in work on directives. Directness is determined by whether directives are addressed to the TV audience or to (often unspecified) third parties: first- and second-person pronouns and national identity categories (e.g., “Australians”) are counted as direct, while instructions aimed at people in general or lacking obvious addressees are indirect. This distinction does not apply in all categories; Hints, for example, are by definition indirect and have no direct alternative.

Forcefulness is determined based on the grammatical and lexical means used to express the directive. For most categories, there are options which can strengthen or weaken the force of the directive. A well-established example is the distinction between *you must* (more forceful) and *you should* (weaker). Even within Hints it is possible to distinguish forceful from less forceful utterances; explicit mention of rules or bans and/or the consequences of inaction was seen as marking forcefulness. The distinction between more and less forceful is one which has wide support in the modality literature, although it is less commonly noted in work on speech acts (Sbisà, 2001). As with other categorizations, decisions relating to relative forcefulness of instances arose from constant consultation between team members relating to instances found in the corpus.

Our aim in making these distinctions was to better understand the strategies and styles these leaders used in directing their populations to follow, or not to follow, specific behaviours. The use of a more direct, more forceful means of delivering a directive suggests to the audience a higher level of urgency and a greater need to adapt their behaviour

Table 2
Corpus composition.

	Ardern (JA)	Johnson (BJ)	Morrison (SM)	Sturgeon (NS)
Role	Prime Minister, New Zealand	Prime Minister, United Kingdom	Prime Minister, Australia	First Minister, Scotland
Media relations website	https://www.beehive.govt.nz/minister/rt-hon-jacinda-ardern	https://www.gov.uk/government/collections/slides-and-datasets-to-accompany-coronavirus-press-conferences	https://www.pm.gov.au/media	https://www.gov.scot/collectio/ns/first-ministers-speeches/
Total briefings	33	37	76	152
Size (tokens)	43,577	46,635	136,928	324,539
Mean word count per file	1320.5	1260.4	1801.7	2135.1
Start/end date	28 January - 5 October	3 March - 30 December	29 January - 24 December	17 March - 21 December

accordingly compared to less direct, lower intensity formulations.

3.3. Statistical analysis

Given the disparities in corpus sizes across leaders (see Table 2), we transformed the raw frequencies of directive use to a value of *n* per 1000 tokens for statistical analysis of the coded data. We then utilised the *partykit* package in R⁵ (version 4.2.1, R Core Team, 2022) to create conditional inference trees (CITs) (Tagliamonte and Baayen, 2012). CITs, like other multivariate tree-based methods, recursively partition the data into two sections to maximise prediction accuracy, making them a versatile multivariate method with easily interpretable outputs (Baayen et al., 2013). CITs, unlike traditional classification and regression trees (CARTs), use significance tests to establish whether a particular split is warranted (Gries, 2020). This technique decreases the need for pruning (Hothorn et al., 2006), while variables with more potential splitting points are not artificially preferred (Boulesteix et al., 2015). CITs are thus used in our study to discover correlations between the predictors and the dependant variable.

The *lm* command was used to perform subsequent linear regression analysis in R, in order to inferentially confirm the significance and effect size of the latent constructs underlying the observed variables (Norouzian and Plonsky, 2018). Standardized parameters were obtained by fitting the model on a standardized, scaled version of the dataset. 95% Confidence Intervals (CIs) and *p*-values were computed using the Wald approximation, which calculates if explanatory variables in a model are significant. To ensure the regression models met required assumptions of normality, the means and SDs of the numeric data (i.e., the normalised frequencies of metadiscourse items) were converted to a normalised dataset through a procedure known as scaling in R. This involves converting each original value into a *z*-score by dividing the values of each column by the corresponding scale value from the input, thus ensuring the data meet normality criteria. Secondly, a Durbin-Watson test was conducted on each regression analysis to determine the potential for autocorrelation (also called serial correlation) in residuals. Each test statistic was approximately 2.0, with test statistic values in the range of 1.5 to 2.5 considered relatively normal while values under 1 or more than 3 are a cause for concern (Field, 2009).

4. Findings / discussion

4.1. Use of directives across leaders

Table 4 shows the combined raw/normalised use of all coded directives for each leader. While Sturgeon has by far the highest average of directives per briefing and Johnson the lowest, Sturgeon's briefings were also the longest and Johnson's the shortest, meaning that the difference is lower when considered in terms of directives per 1000 tokens.

⁵ The R notebook for our analysis can be downloaded here: <https://tinyurl.com/4225ymy>

Fig. 1 shows a scaled comparison of the four PMs in terms of directive use. This makes clear Sturgeon's heavy use of directives and also Morrison's much lower relative use. It has been noted elsewhere (Reyes-Bernard et al., 2021) that Morrison's briefings generally focused on economic recovery, which may go part way to explaining his lower overall use of COVID-related instructions. We can also note that, at least in terms of density of directives, Ardern and Johnson are quite similar, which is an interesting result given the very different perceptions of these leaders' effectiveness in dealing with COVID-19 and communications with the public; density of directives alone cannot reveal a great deal about communication strategies.

A CIT analysis (Fig. 2) appears to confirm the findings shown in Fig. 1 inferentially. This presents a tree-based comparison of speakers' scaled normalised frequencies of directive use shown in Fig. 1. Variance in these scaled frequencies by speaker is represented by critical splits in the scaled data, with the first such split suggesting Sturgeon's directive use is likely to be higher than that of the other speakers, while the next split suggests Morrison's directive use is likely to be lower than that of the other speakers.

To confirm these results, a linear regression model was run in R (estimated using OLS, a method for estimating the unknown parameters in a linear regression model) to predict the use of directives (*n* per 1000) across the four leaders. The model explains a statistically significant albeit weak proportion of variance ($R^2 = 0.12$, $F(3, 294) = 13.97$, $p < .001$, adj. $R^2 = 0.12$). The model's intercept (Sturgeon), is at 0.30 (95% CI [0.15, 0.45], $t(294) = 3.99$, $p < .001$). Within this model, the effect of Speaker [Ardern] is statistically significant and negative ($\beta = -0.39$, 95% CI [-0.74, -0.03], $t(294) = -2.15$, $p = .032$; Std. $\beta = -0.39$, 95% CI [-0.74, -0.03]), the effect of Speaker [Johnson] is statistically significant and negative ($\beta = -0.36$, 95% CI [-0.70, -0.02], $t(294) = -2.09$, $p = .038$; Std. $\beta = -0.36$, 95% CI [-0.70, -0.02]), and the effect of Speaker [Morrison] is statistically significant and negative ($\beta = -0.85$, 95% CI [-1.11, -0.59], $t(294) = -6.43$, $p < .001$; Std. $\beta = -0.85$, 95% CI [-1.11, -0.59]). These results confirm Sturgeon's use of directives in general was heavier in her speeches than those of the other PMs. This finding also seems to confirm that Sturgeon viewed the briefings as a vehicle for communicating COVID-related instructions to the public, which is not always true for the other leaders, who delivered briefings that included no directives (Ardern and Morrison) or very few (Johnson).

4.2. Directives by type

A clearer idea of the styles of the leaders can be obtained by examining the types of directives that they used. The normalised frequencies of directives for each type are shown in Fig. 3. As we can see, the types of directive that occur most frequently are Imperatives, followed by Direct Modal Declaratives (MDD), Hints, and Indirect Modal Declaratives. It is interesting to note the predominance of both very direct (Imperatives, MDD) and very indirect (Hints) options within the context of monologic COVID-19 briefings. This tendency towards extremes of directness may be associated with the need by these leaders to make both high- and low-

Table 3
Coding of directives in the study.

CODE	Type of Directive	Linguistic Realisations	Examples
1	Imperative Command	Imperative verb or <i>let(s) + Verb</i>	<i>stay at home, protect the NHS and save lives</i> (Johnson, 11 May)
2	Performative Direct	<i>[I / we] + Verb + [you / national identity category] + to-infinitive</i>	<i>To older people - we are asking you to stay away from your grandkids</i> (Sturgeon, 20 March)
3	Performative Indirect	<i>[I / we] + Verb + [people/everyone] + to-infinitive</i>	<i>We continue to ask everyone who is on public transport and planes to wear a masque or face covering</i> (Ardern, 24 August)
4	Modal Declarative Direct	Declarative modal statement with first-or second-person subjects	<i>you should still be spending the majority of your time at home</i> (Sturgeon, 1 June)
5	Modal Declarative Indirect	Declarative modal statements with unspecific third-person addressee (including semi-modals <i>need to/have to</i>)	<i>People should Stay Alert</i> (Johnson 11 May) <i>Gatherings at home need to be capped at 10</i> (Ardern, 11 May)
6	Modal Int Request	Interrogatives with modal auxiliaries and first or second person subjects	<i>Can you build in contact tracing tools or mechanisms to keep track of your supply train and customers?</i> (Ardern, 9 April)
7	BE Verbed to	<i>BE + Verbed (+ to-infinitive) with verb of obligation or prohibition</i>	<i>mass gatherings are still prohibited</i> (Johnson, 3 July) <i>all licensed bars and restaurants will be required to close indoors and outdoors from 6pm this evening</i> (Sturgeon, 9 October)
8	Impersonal direct	Impersonal construction (<i>it + is + Adjective + that/to-infinitive</i>), addressed to first or second person, or to national identity categories	<i>it is absolutely essential that we guard against future outbreaks</i> (Sturgeon, 14 August)
9	Impersonal indirect	Impersonal construction (<i>it + is + Adjective + that/to-infinitive</i>), no obvious addressee.	<i>it's vital that everyone exercises the greatest possible personal</i>

Table 3 (continued)

CODE	Type of Directive	Linguistic Realisations	Examples
10	Nominal	Directive with performative Noun	Nouns of obligation referring to duties, prohibitions <i>responsibility</i> (Johnson, 16 December) <i>There is now a travel ban on visitors from Denmark into any part of the UK</i> (Sturgeon 9 November)
11	Verbing	Directive realized by Verbing	(<i>this/that means</i>) Verb+ing indicating action (not) to be performed <i>That means, in particular, not visiting other people's houses</i> (Sturgeon, 13 April)
12	Infinitive	Directive realized by infinitive	to-infinitive referring to action (not) to be performed <i>And on top of that, to restrict the amount of time a patron is in the premises to no more than 30 min and preferably less</i> (Morrison, 24 March)
13	Condition	Directive realized by conditional clause	Directive as a condition under which an action is permitted using e.g. <i>provided / if / as long as</i> <i>As long as physical distancing between different households is maintained, this can include overnight stays</i> (Sturgeon, 10 July)
14	Noun Phrase	Directive realized by nominalization or noun	Nominalizations/nouns signalling the desired action <i>and use of isolation and quarantine for those exposed to COVID</i> (Ardern, 15 July) <i>let me just close everybody again of FACTS - the five rules that we all must follow to stay as safe as possible: Face coverings in enclosed spaces, ...</i> (Sturgeon, 10 August)
15	Hint	Hint, i.e. indirect directive	Indirect instruction not associated with a specific realization <i>It will still be possible for the police to break up large and irresponsible gatherings</i> (Johnson 23, June) <i>the more we do the right thing together as Australians, the more lives we will save</i> (Morrison, 22 March)
16	Incomplete	Incomplete	Incomplete / abandoned <i>we now no longer will be</i>

(continued on next page)

Table 3 (continued)

CODE	Type of Directive	Linguistic Realisations	Examples
		directive or false start	<i>allowing anyone unless they're a citizen or a resident or a direct family member in those cases (Morrison 19 March)</i>

Table 4

Overview of quantitative data on directives for each leader.

	Directives			
	Ardern	Johnson	Morrison	Sturgeon
Total directives (raw)	602	544	1153	4558
Avg directives per briefing	18.2	14.7	15.1	30
Mean (n per 1000 tokens)	11.47	11.67	8.27	14.17
Std. Deviation (n per 1000 tokens)	9.24	5.36	7.36	5.54

level impositions on their respective populations, leading to an adjustment in their directive choices in response to “the assumed degree of face-threat” involved in specific utterances (Decock and Depraetere, 2018). It is important to recall, however, that the meaning and interpersonal effects of (in)directness are highly nuanced and often culturally specific (Haugh, 2015).

As Fig. 3 also indicates, a number of directive categories were very rarely found, including some that were only in the communication of specific leaders, such as Incomplete directives, which are only attributed to Morrison.

To determine the statistical likelihood of the use of particular directive types across these leaders, a CIT was conducted that included all 13 directive types coded within our dataset (alpha = 0.0033 for significance).

The CIT results shown in Fig. 4 suggest that the use of imperatives is key to the variation across the leaders ($p < .001$). While this finding might seem unsurprising, bearing in mind the close association between imperatives and directives, the material point, shown by Fig. 3 and even more clearly in Fig. 5, is that the distribution of imperatives is not even across the four leaders: high use of imperatives is particularly associated with Sturgeon’s briefings. In contrast, the use of Hints (associated with high imperative use) is particularly prominent in Ardern’s speeches ($p = .001$). We also found that the use of modal declarative directives with first- and second-person pronouns is a key feature of Johnson’s speeches. Of these leaders Morrison has the lowest prevalence of the most direct types of directives and a relatively higher frequency of the most indirect, Hints, providing support for Marsen and Ali-Chand’s (2022) observation that he has a tendency for indirectness. We now examine these findings in more detail.

4.2.1. Imperatives

Fig. 5 indicates Sturgeon’s preference for imperative forms and the other leaders’ relatively lower use of this type of directive; Johnson and Morrison in particular seem less inclined towards using this direct option.

A linear regression model was used to confirm the variance in the CIT for use of imperatives across the leaders, and this explained a statistically significant and substantial proportion of variance ($R^2 = 0.35$, $F(3, 294) = 52.97$, $p < .001$, adj. $R^2 = 0.34$). The model’s intercept, corresponding to Speaker = Sturgeon, is at 0.56 (95% CI [0.43, 0.69], $t(294) = 8.57$, $p < .001$). Within this model, the effect of Speaker [Ardern] is statistically significant and negative (beta = -0.84 , 95% CI [-1.15 , -0.54], $t(294) = -5.42$, $p < .001$; Std. beta = -0.84 , 95% CI [-1.15 , -0.54]), the effect of Speaker [Johnson] is statistically significant and negative (beta = -1.05 , 95% CI [-1.34 , -0.76], $t(294) = -7.06$, $p < .001$; Std. beta = -1.05 , 95% CI [-1.34 , -0.76]), while the effect of Speaker [Morrison] is statistically significant and negative (beta = -1.33 , 95% CI [-1.55 , -1.11], $t(294) = -11.69$, $p < .001$; Std. beta = -1.33 , 95% CI [-1.55 , -1.11]). Sturgeon’s heavy use of imperatives compared with the three other PMs is therefore confirmed.

This finding reflects the care Sturgeon took with wording instructions directly and in repeating them at key points in her briefings - usually to conclude the message. This communicative strategy emerges

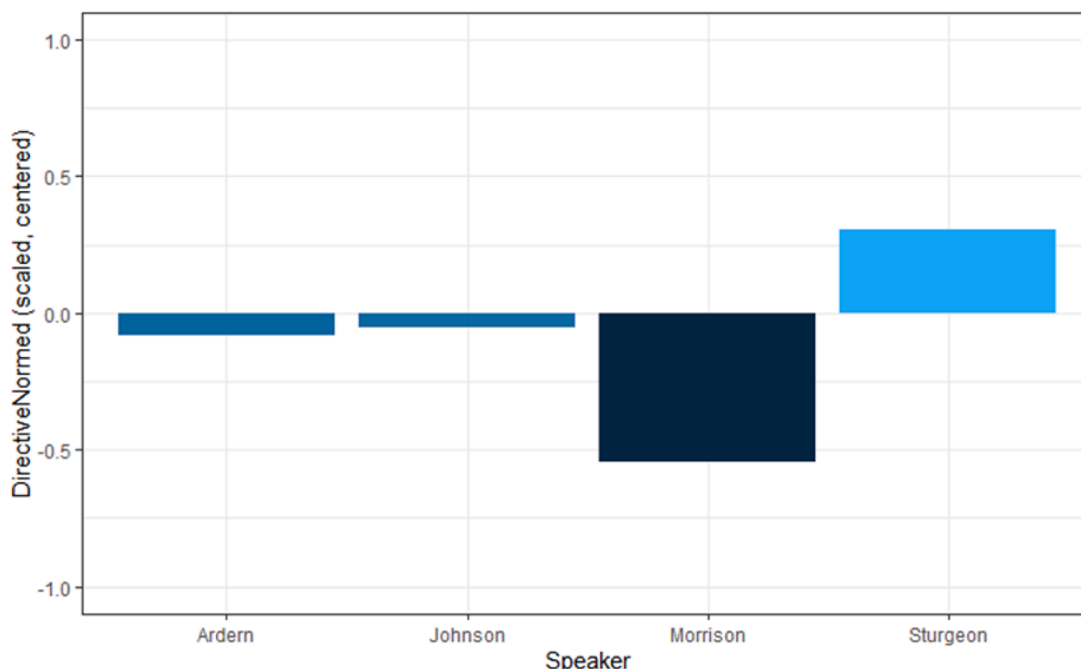


Fig. 1. Scaled comparison of the overall use of directives by the four leaders.

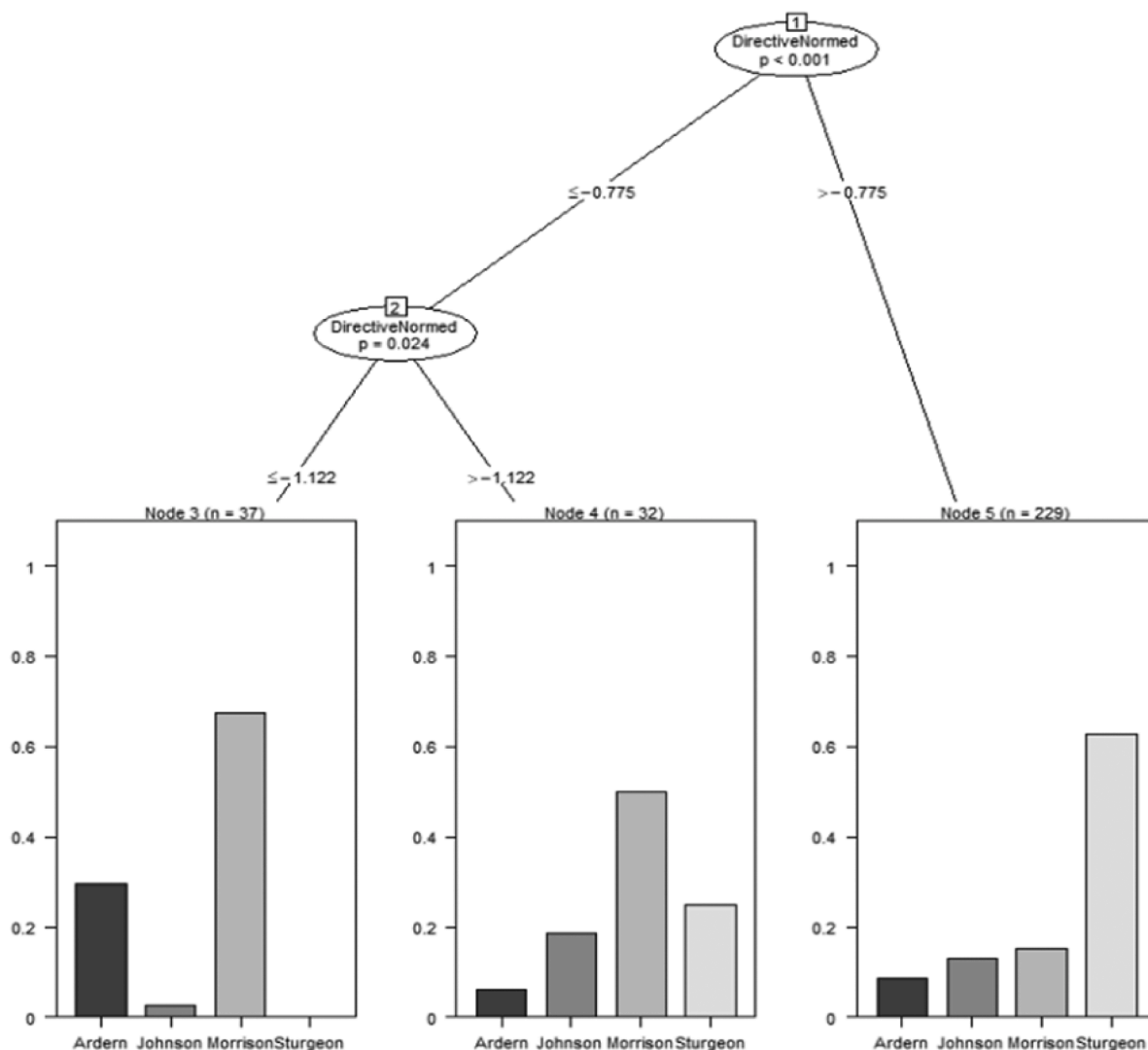


Fig. 2. Conditional inference tree of directive use across speakers (scaled).

particularly clearly after the introduction on 19 June of the FACTS acronym referring to five key instructions which were repeated in every subsequent briefing with very similar wording. Fig. 6 below shows the relevant extract from the 19 June briefing with imperatives underlined. Note that both “ordinary imperatives” (*avoid, clean*) and “*let*-imperatives” (*let me run through*) (Huddleston and Pullum, 2002) are included in this category; ordinary imperatives are seen as more forceful than *let*-imperatives. Sturgeon’s use of imperatives aligns with recommendations in the literature to keep messages simple and concise (Lunn et al., 2020; McClaughlin et al., 2021). We can also note here that two of the FACTS instructions are not imperatives, but Noun Phrase type directives, where a noun phrase is presented without a finite verb. The use of Noun Phrase directives seems to be a strategy for referring to rules that the audience is expected to know about in a simple and straightforward way, although it is less direct and forceful than the use of imperatives.

Another feature of Sturgeon’s style seen in Fig. 6 which also contributes to the higher concentration of imperatives in her briefings is her fondness for expressions using *let*-imperatives of the form *let me* + communicative verb, as if asking for permission to speak (e.g., *let me stress, let me be clear, let me begin/end, let me thank*). Sturgeon uses this expression on average almost twice in every briefing and almost five times as frequently as Johnson. The use illustrated in Fig. 6, which signals what is coming next (Carter and McCarthy, 2006), is the most

common one, with just under half of all instances. A similar use of *let me* is to introduce explanations, as in example 3 where it is used to draw attention to the importance of the following explanation.

- (3) *Let me be clear, because I know it is a question that has been asked, that doesn’t limit you to seeing just one specific household*

In contrast to the forcefulness and urgency of ordinary imperatives, this use of *let*-imperatives can be seen as Sturgeon acknowledging and including her audience in the briefings, a characteristic noted by Dada et al. (2021). At the same time, instances involving *let me* + communicative verb introducing other directives (around 11%), such as examples 4 and 5, suggest a different, more forceful interpretation.

- (4) *Let me state very clearly how I expect people to be behaving. People should be staying at home*
- (5) *Let me stress how important it is that people in those households do self-isolate for the entire period advised*

Let me in these examples seems to draw attention to the fact that it is the First Minister who is delivering the directive by emphasising her expectations and her evaluation of the importance of following the instructions. This contrast in use of the same directive structure points to the importance of follow-up research into how directives combine in

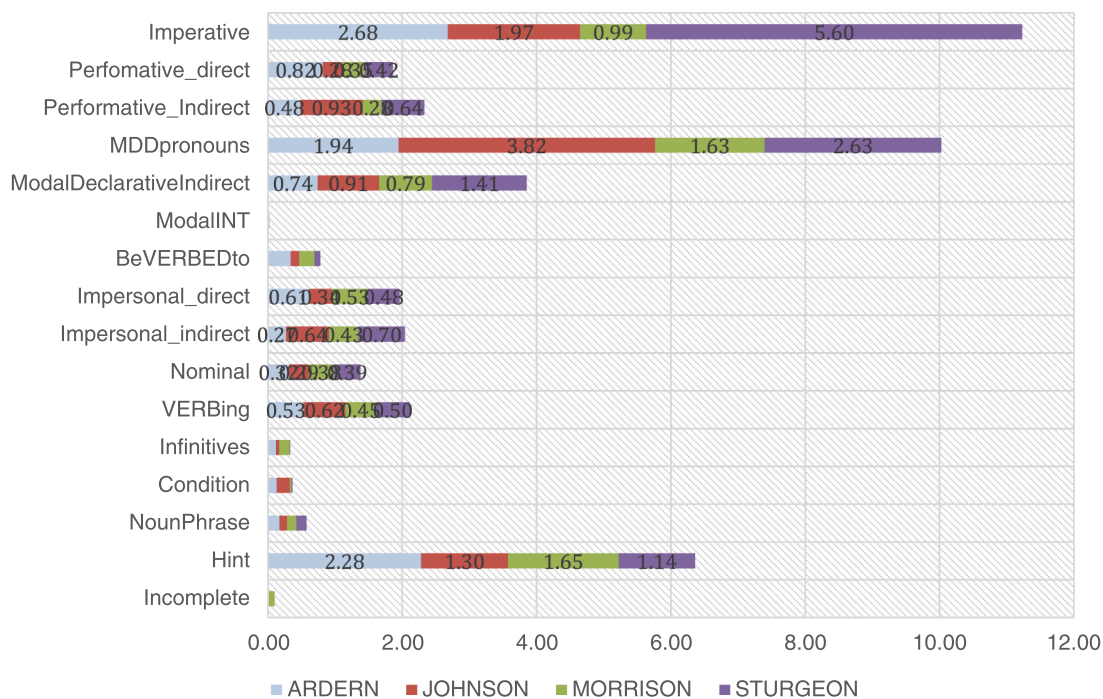


Fig. 3. Distributions of normalised frequencies (per 1000 tokens) for each category and each leader.

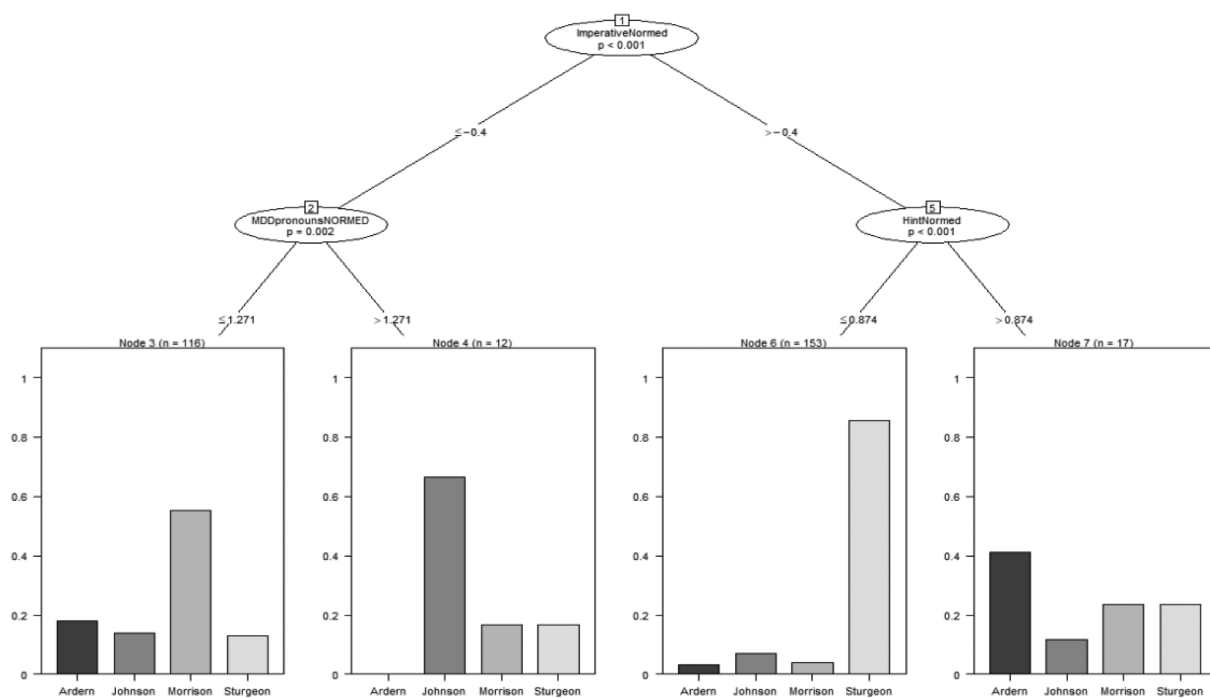


Fig. 4. CIT for use of directive subcategories across the four leaders (scaled).

discourse in ways that we have not investigated in this study.

4.2.2. Modal declaratives direct

Johnson’s preference for the use of modal declaratives with first- and second-person pronouns in the briefings was noted in reference to Fig. 4. This is more obvious in Fig. 7, which shows that this preference is pronounced compared to the other leaders, although Sturgeon also has a slightly higher use of this type of directive than Arden and Morrison.

Johnson tends to use this directive type at key moments such as his 23 March announcement of lockdown shown in example 6. We can see

three instances of MDD in this extract, each using a different pronoun and all involving the more forceful *must*. The self-imposed directive *I must give*, used here to preface the announcement, makes an interesting contrast with Sturgeon’s preference for *let me give* in a similar situation in framing it as an obligation rather than a request for permission to make an announcement. The use of *we must do* is an example of inclusive/patriotic *we* - an interpretation that is suggested by the use of the conjunction *because* indicating that staying at home is integral to stopping the spread. As also noted by McCloughlin et al. (2021), Johnson in general prefers to combine forceful forms with *we*, and the third instance

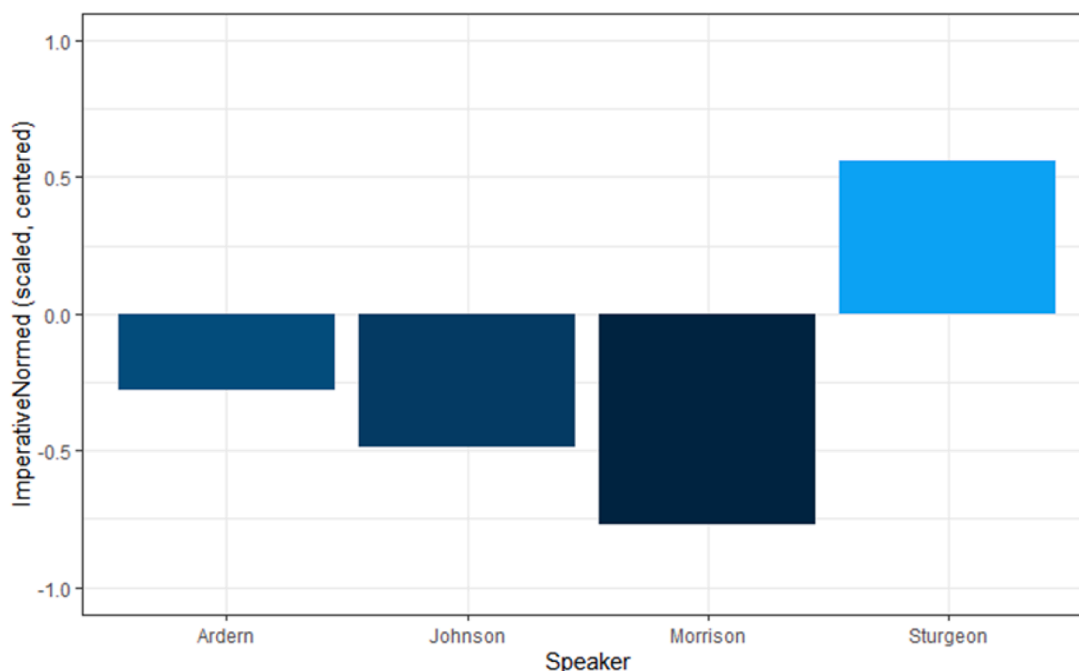


Fig. 5. Scaled comparison of use of Imperatives across the four leaders.

Each letter of that word FACTS should serve to remind us all of the key measures we need to comply with. Let me quickly run through them. And those measures are:

***F**ace coverings in enclosed spaces*

***A**void crowded places*

***C**lean hands and surfaces regularly*

Two metre distancing; and

***S**elf-isolate and book a test if you have symptoms.*

Remember these FACTS and that will help all of us to stay safe and protect each other as well.

Fig. 6. Extract from Sturgeon's 19 June briefing introducing FACTS.

in example 6 is typical of this feature; it seems easier to use forceful *must* if one is including oneself amongst those being directed to act. However, the use of stronger forms with second-person as seen here is relatively unusual in our corpus, perhaps reflecting an awareness that *must* and *have to* are more forceful and should therefore be used carefully, perhaps only in the most urgent situations.

- (6) *From this evening I must give the British people a very simple instruction - you must stay at home. Because the critical thing we must do is stop the disease spreading between households.* (Johnson, 23 March)

A second linear regression model was used to confirm the variance in the CIT for use of MDD across the leaders, which explained a statistically significant and weak proportion of variance ($R^2 = 0.10$, $F(3, 294) = 11.22$, $p < .001$, adj. $R^2 = 0.09$). The model's intercept, corresponding to Speaker [Johnson] is at 0.66 (95% CI [0.35, 0.96], $t(294) = 4.19$, $p <$

.001). Within this model, the effect of Speaker [Sturgeon] is statistically significant and negative (beta = -0.57 , 95% CI [-0.91 , -0.23], $t(294) = -3.26$, $p = .001$; Std. beta = -0.57 , 95% CI [-0.91 , -0.23]), the effect of Speaker [Arden] is statistically significant and negative (beta = -0.90 , 95% CI [-1.35 , -0.45], $t(294) = -3.93$, $p < .001$; Std. beta = -0.90 , 95% CI [-1.35 , -0.45]) and the effect of Speaker [Morrison] is statistically significant and negative (beta = -1.05 , 95% CI [-1.42 , -0.67], $t(294) = -5.48$, $p < .001$; Std. beta = -1.05 , 95% CI [-1.42 , -0.67]). This confirms Johnson was statistically more likely to make use of MDD with first- and second-person pronouns than the other leaders, at least when the use of imperatives was relatively low (see also Fig. 4).

A breakdown of the pronouns used by each leader when they employ MDD directives is seen in Fig. 8. We can see here that Johnson makes more frequent use of first-person pronouns, both singular and plural, than the other leaders, while Sturgeon makes the most frequent use of *you*; this makes up a far higher proportion of Sturgeon's overall MDD directives than for other leaders. It is also notable how much more

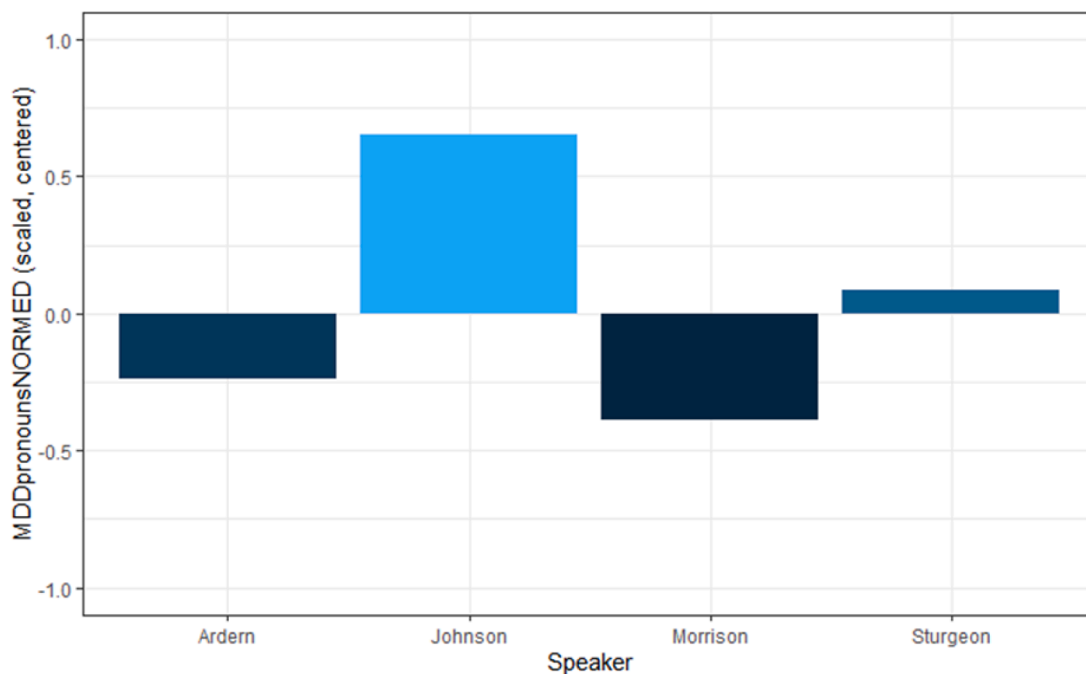


Fig. 7. Relative preference for modal declaratives with first- and second-person pronouns (scaled).

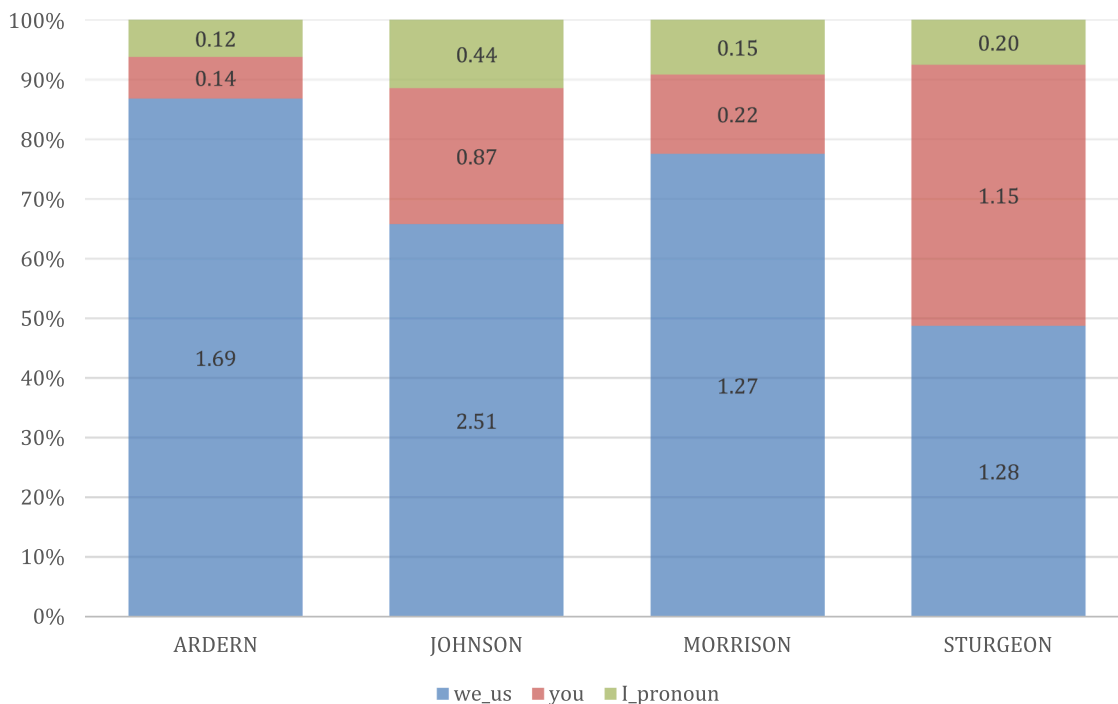


Fig. 8. Relative frequencies of first/second person pronouns used with MDD directives in briefings of each leader (normed frequencies within the columns).

frequently Ardem uses *we* than *you*, which is in line with previous observations that her communication emphasises social solidarity (McGuire et al., 2021). As for Johnson’s preference for using *we*, this seems to be part of a general strategy in the Downing Street briefings, as it is observed across speakers (Williams and Wright, 2020).

The use of second-person pronouns with MDD directives shown in example 7, which is taken from Sturgeon’s briefings but is representative of the pattern for all four leaders. It is interesting that Sturgeon switches from a more indirect formulation (*people should not be going out*) to directly addressing the audience as she moves into the list of directives.

(7) *Other than for a few very specific reasons, people should not be going out. You should not be meeting up with people from other households. You should observe social distancing measures when it is essential for you to go out. And if you or other people in your household show signs of COVID 19, remember, a fever or a persistent cough, you should be isolating completely.* (Sturgeon, 10 April)

We see in example 7 the general preference for weaker, less forceful forms. The choice of *should* seems to indicate an awareness that formulations such as *you must/have to* are somehow to be avoided. At the

same time, for the audience, using this less forceful item might suggest that compliance is somehow less pressing.

4.2.3. Hints

Our third main finding is Ardern’s relative preference for the use of Hints compared to the other leaders (see Fig. 9). Given that she has been widely praised for clear communication, this is surprising, as Hints by definition are inexplicit, relying on the audience to understand what is meant from context (Ervin-Tripp, 1976). This is not entirely in line with Marsen and Ali-Chand’s (2022) claim that Morrison is the more indirect in that his use of Hints is less pronounced than Ardern’s. However, it should be noted that this is not the only way indirectness is shown.

A linear regression model was used to confirm the variance in the CIT for the use of Hints across PMs, explaining a statistically significant and weak proportion of variance ($R^2 = 0.10$, $F(3, 294) = 11.22$, $p < .001$, adj. $R^2 = 0.09$). The model’s intercept, corresponding to Speaker = Johnson, is at 0.66 (95% CI [0.35, 0.96], $t(294) = 4.19$, $p < .001$). Within this model, the effect of Speaker [Sturgeon] is statistically significant and negative (beta = -0.57 , 95% CI [-0.91 , -0.23], $t(294) = -3.26$, $p = .001$; Std. beta = -0.57 , 95% CI [-0.91 , -0.23]), the effect of Speaker [Ardern] is statistically significant and negative (beta = -0.90 , 95% CI [-1.35 , -0.45], $t(294) = -3.93$, $p < .001$; Std. beta = -0.90 , 95% CI [-1.35 , -0.45]), and the effect of Speaker [Morrison] is statistically significant and negative (beta = -1.05 , 95% CI [-1.42 , -0.67], $t(294) = -5.48$, $p < .001$; Std. beta = -1.05 , 95% CI [-1.42 , -0.67]). This confirms that Ardern and Morrison used Hints more often in their briefings than either Johnson or Sturgeon.

It is worth noting, however, that Ardern often uses Hints in combination with other more direct and more forceful options to encourage the public to work together in a way that Morrison does not. Examples 8 and 9 demonstrate this strategy. In both examples, Hints encouraging the audience to stick together and to avoid irresponsible behaviour are used to back up imperatives. Ardern shows some skill here in combining direct and forceful directives and then switching to *we* to emphasise the importance of social solidarity. In example 10 the implication is that the audience should access this advice to overcome the issues of misinformation. Again here we can note the switch of addressee in the directive, in this case to *you*, which seems to make it more relevant to the audience.

- (8) *Go home tonight and check on your neighbours, start a phone tree with your street, plan how you’ll keep in touch with one another. We will get through this together, but only if we stick together.* (Ardern, 23 March)
- (9) *so please be vigilant at level 2. Irresponsible behaviour will take us backwards.* (Ardern, 5 November)
- (10) *Finally, this is a time when I know people will want as much information as possible. It’s also a time when there is plenty of misinformation. All the advice from the government about COVID-19 and how it affects you is available at www.covid19.govt.nz* (Ardern, 21 March)

In short, Hints appear to be a supplementary resource for Ardern, adding weight to other directives which she issued more directly and forcefully.

5. Conclusion

This study is the first to our knowledge to attempt a rigorous analysis of the use of directives in crisis communication in general and more specifically in COVID-19 briefings. We have presented an overall picture of how Ardern, Johnson, Morrison, and Sturgeon used directives through a focus on overall use and on the major types of directive. Collectively, their COVID-19 communication featured frequent use of both the most direct types of directives (Imperatives, MDD) and the most indirect (Hints). We have also uncovered key differences between these leaders: Sturgeon relied on Imperatives more heavily than did the other leaders; Johnson made more frequent use of MDDs to deliver instructions; and both Ardern and Morrison often used Hints but, unlike Morrison, Ardern did so alongside Imperatives. Morrison is revealed to be the least enthusiastic user of directives, particularly of more direct and forceful types. Analysis of this variation provides some evidence to support previous claims that Ardern and Sturgeon were relatively effective compared to their male counterparts, in particular Morrison.

The finding that Imperatives and MDDs are the most prevalent is expected based on previous research. The prevalence of Hints, meanwhile, is less expected based on the need for clarity and urgency in briefings under these circumstances, although in the hands of an effective communicator like Ardern, they seem to have a place. Hints can be

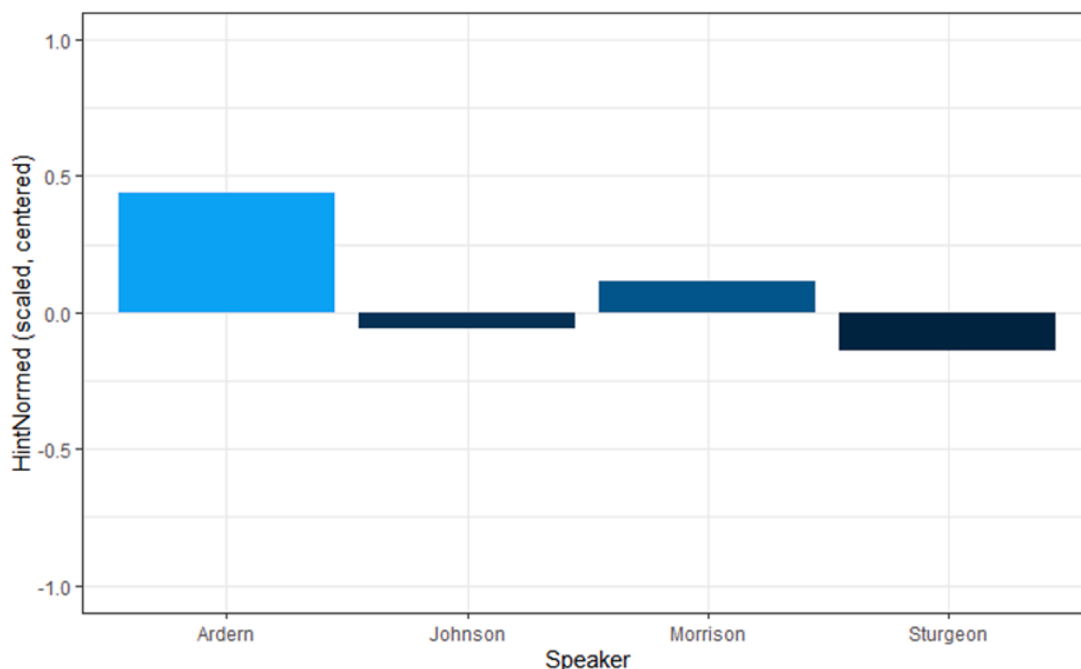


Fig. 9. Relative use of hints across the four leaders (scaled).

an effective means of reducing face-threat, but in contexts where much is riding on people understanding and doing what needs to be done, overreliance on Hints alone may provide insufficient clarity to promote compliance. On the basis of our findings and previous literature on crisis communication, clarity appears to be of paramount importance in crisis situations, particularly when supported by empathy and social solidarity. In analogous situations, therefore, leaders might consider making judicious use of Imperatives to mark directness and urgency, combined with other formulations that suggest social solidarity, such as those involving inclusive *we* (*we must/should*), and Hints might be best reserved for supporting and summarising statements.

The discussion of our findings has suggested that the combination of different types of directives is a feature of effective crisis communication and that directives are not evenly distributed across the briefings but tend to be used together in strategically important places. However, we have not been able to investigate these aspects of directive use in depth in this paper. Another area that we have not explored but that seems of importance is the investigation of choice of directive types in relation to the level of imposition. For example, it may be easier to require one's audience to wash their hands than to stay at home, and it seems likely that this would be reflected in the formulation of the relevant directives. It would also be interesting to expand the investigation to a wider range of leaders, including the use of directives in different languages.

We hope that research that explores questions of this sort will find the framework of directives developed for this study useful. Our framework is informed by earlier studies but has been expanded to account for directives in monological political briefings. While this analysis focuses on the most salient parameters for our corpus, the framework is generic and thus has the potential to be applied to other data sets. It may also have relevance to contexts such as education and healthcare, in which people are routinely instructed to act in particular ways for their own benefit. Understanding the full range of options for how to communicate those instructions can promote critical self-reflection on the part of educators and healthcare practitioners, which may in turn improve the uptake of their recommendations. The new and expanded typology of directives generated through this research should also prove helpful to linguistic researchers exploring directive usage, particularly in high-stakes monological contexts.

6. Author vitae

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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