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The effects of proficiency and textual enhancement technique on noticing

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ABSTRACT

Textual enhancement (TE) refers to manipulation of a text to make specific linguistic targets more perceptually salient. Typically, the purpose of TE is to implicitly draw learners' attention to target forms, as it has been postulated that noticing the gap between one's interlanguage and the target is a first step towards acquisition (Smith, 1991, 1993). This study investigated the effects of two forms of TE on the acquisition of the English third-person singular /~s/ and /~es/ forms among 382 Japanese university students. Two grammaticality judgement tasks in a pre/posttest design indicated small, but significant, increases among the two experimental groups compared to a comparison group (unenhanced text), and a control group (no treatment). The relative effect of language proficiency was also examined, with students of lower proficiency in each experimental group showing greater improvement over their control groups than their counterparts of higher proficiency. Post-interviews revealed that participants generally had not been successful at noticing the target form, and that they were predominately engaged in processing the readings for content, not form. Overall results suggest that TE is slightly effective, but it is argued that its effects may be enhanced by combining it with training students in effective learning strategies.

1. Introduction

Input enhancement (IE), defined as "techniques for manipulating the target language input in order to increase the saliency of certain linguistic elements in otherwise meaning-oriented activities" (Reinders & Cho, 2012), continues to be a popular area of second language acquisition (SLA) research and practice. Perhaps part of the appeal of IE is that on the theoretical front, it helps bridge the distance between proponents of naturalistic language learning and instructed SLA. Furthermore, its basic premise that more attention results in more learning (Schmidt, 2010) feels intuitive, as teachers tend to naturally use various techniques (e.g., repetition, gestures, speed reduction) to try to make target features as salient as possible.

IE can take many forms (e.g., visual, auditory, kinesthetic) and be used for many features (e.g., grammatical, lexical, phonemic). The current study sought to determine the effect of textual enhancement (TE) on the acquisition of the English third-person /~s/ and /~es/ forms among Japanese university students. While similar work investigating the efficacy of TE has been conducted in the past to inconclusive results, Lee and Huang's meta-analysis (2008) attributes this to a lack of

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generalizability among studies due to methodological idiosyncrasies such as differing experimental tasks, target forms, degrees of prior knowledge, enhancement techniques, and the use of comparison (rather than true control) groups.

The current study sought to improve on the methodological issues of past investigations by concurrently employing two different forms of TE as experimental treatments to test if TE technique affected the degree of noticing/acquisition. These two experimental groups were compared against both a comparison group (non-enhanced text), and a true control group (no treatment), to tease apart whether gains could be attributed to experimental treatments or merely exposure to the target forms. Each group was also evenly divided into higher and lower levels of English proficiency to test if quantifiable differences could be detected. This variable has not often been considered in past TE research despite suggestions that learners with limited processing resources naturally prioritize comprehension (Gass, 1997; VanPatten, 1990; Williams, 1999) and thus focus-on-form treatments would be more conducive to learners with higher levels of automatization. Finally, post-assessment interviews were conducted, which allowed for a deeper interpretation of the quantitative data collected by investigating participants' cognition/awareness levels regarding the enhancements in a mixed-methods design.

2. Review of the literature

2.1. The importance of perception

The importance of perception and the ability of the learner to identify the gap between their current interlanguage and the target have been highlighted in works from multiple fields of SLA. Perhaps the most illustrative theories can be found in pronunciation instruction (PI), with theories such as Flege's (1988, 2005) Speech Learning Model (SLM) and Best's (1994, 1995; Best & Tyler, 2007) Perceptual Assimilation Model (PAM) being the most often cited perception-based models. The SLM, taking the stronger position of the two, essentially states that perception is a necessary precursor to production. A learner must first be able to detect the contrast between a novel L2 sound and the next closest L1 sound, and form a new mental representation before being able to produce it. In general, perception-based PI research has shown repeatedly that such training is highly effective at increasing accurate production, even in the absence of explicit production instruction (for meta-analyses of PI research, see Lee, Jang, & Plonsky, 2015; Saito & Plonsky, 2019; Sakai & Moorman, 2018).

2.2. The Noticing Hypothesis

Developing around the same time as the SLM was Schmidt's (1990) highly influential Noticing Hypothesis. Schmidt further distinguished between the ideas of perception, noticing, and understanding as three distinct levels of awareness. Perception, the widest category, can be conscious, subconscious, or even subliminal. Schmidt contrasted this with noticing, which he envisioned only began when the learner consciously focused their awareness to the stimulus. However, this level does not necessarily entail any reflection or analysis on the part of the learner, merely a conscious direction of attention. The conscious effort to process the significance of the noticed stimulus, termed understanding, is the final level where acquisition is said to take place. Thus, by this definition, it is possible to perceive without noticing, or notice without understanding. However, Schmidt took the extreme stance of stating that understanding (i.e., learning) is impossible without noticing/perceiving, much the same position as the SLM.

Schmidt attempted to set his theory apart from competing contemporary ideas by clarifying terminology. For example, both Corder (1967) and Krashen (1982) argued that only a portion of the available linguistic input becomes *intake*, essentially the "subset of linguistic input that helps the acquirer acquire language" (Krashen, 1982, p. 102). However, the exact process whereby input becomes intake remained ambiguous, as Krashen's notion of *comprehensible input* was insufficient to explain the mechanism. After all, not everything that is comprehensible is guaranteed to be taken in by the listener. Several theorists (e.g., Chaudron, 1985; Faerch & Kasper, 1980; Slobin, 1985) attempted to conceptualize intake as a two-step process. *Preliminary intake* consisted of the portion of the input that the listener attended to in order to communicate; only the information that is retained for further processing is seen to result in *final intake*, eventually becoming incorporated into the listener's interlanguage. These conceptualizations view the portion of the preliminary intake that was not retained for further processing as being only held temporarily in working memory and eventually lost (Leow, 2015; VanPatten, 2004).

A number of other scholars have incorporated facets of noticing into their SLA theories, most notably: (a) The Interaction Hypothesis (Ellis, 1991; Long, 1996), which added that interactions may aid learners in noticing the gap between their interlanguage and the target, (b) Gass and Selinker's (1994) model, and (c) Ellis' computation model (1997), both of which place conscious noticing of elements of the input (i.e., intake) as the first step towards L2 acquisition. Regardless of the theory, the common thread is that essentially, more attention results in more learning (Baars, 1988; Schmidt, 2010) and "people will learn about the things they attend to and they will not learn much about the things they do not attend to" (Logan, Taylor, & Etherton, 1996, p. 620).

2.3. Input enhancement

IE developed as a way to implicitly direct learners' attention to target features in the hopes of triggering deeper subsequent processing, leading to potential learning. The focus of the current study, textual enhancement (TE), refers to altering a text by visually marking the target items by such means as highlighting, underlining, italicizing, bolding, enlarging, etc. (Han, Park, &

Combs, 2008). Another common technique used on audio samples is aural IE, whereby the speech or recording is manipulated by increasing the volume, reducing the speed, or introducing pauses to isolate the target items (e.g., Reinders & Cho, 2012). Input flooding, or increasing the frequency of the target form (e.g., Loewen, Erlam, & Ellis, 2009; Spada & Lightbrown, 1999), is also commonly used, along with kinesthetic IE (i.e., clapping to the rhythm or initiating some action at the utterance of a keyword) (e.g., Burri & Baker, 2016; Lee, 2020; Lee, Plonsky, & Saito, 2020).

Unfortunately, while IE has shown to be effective in domains such as pronunciation instruction (e.g., Gluhareva & Prieto, 2016; Zhang, Baills, & Prieto, 2018) or listening comprehension (Lee, 2020), where the enhanced forms are typically central to successful deciphering of the message, conclusive findings from grammar instruction have proved much more elusive. As L2 learners have difficulty acquiring forms which are redundant, or morphologies which carry little meaning (Overstreet, 1998; VanPatten, 1989; Winke, 2013), IE would seem to be an ideal method to draw learners' attention to such non-salient forms and trigger further processing. In fact, grammatical items noticed in context (i.e., where the primary focus is on meaning) are believed to be more likely to be retained (Sharwood Smith, 1993). However, Lee and Huang's (2008) early meta-analysis of TE studies found that on average, only a very small effect size of $d = 0.22$ [95% *CI*: 0.03, 0.47] was observed for learning under TE conditions, though this was contrasted with comparison groups (typically input flooding) so should not be considered as a measure of absolute gains (e.g., versus a control group).

Furthermore, studies which have investigated whether TE resulted in increased noticing have reported mixed results. While some studies observed increased noticing with enhanced texts (e.g., Issa, Morgan-Short, Villegas, & Raney, 2015; Izumi, 2000, 2002; Simard & Foucambert, 2013; Winke, 2013), others found no significant attentional differences between enhanced and unenhanced conditions (e.g., Bowles, 2003; Indrarathne & Kormos, 2016; Leow, 2001; Leow, Egi, Nuevo, & Tsai, 2003; Loewen & Inceoglu, 2016). However, as these studies employed comparison groups, it still remains unclear whether the TE was ineffective at raising noticing, or if something about the text itself triggered noticing, even in the unenhanced condition.

Perhaps more importantly, even some studies which suggested that TE resulted in increased noticing did not necessarily see corresponding increases in measures of acquisition (Issa et al., 2015; Leow, 2009; Loewen & Inceoglu, 2016; Winke, 2013). The presence of these null findings suggests that enhancement alone is sometimes insufficient to promote learning (Leow & Martin, 2017), leading some studies to incorporate explicit instruction for students to attend to the target form, or TE in tandem with explicit metalinguistic explanation to increase deeper processing (e.g., Indrarathne & Kormos, 2016; Leow, Donate, & Gutiérrez, 2019).

While the effectiveness of TE has generally been shown to be enhanced by accompanying explicit instruction, the conflating of techniques and study designs has been an ongoing issue in TE research which has prevented us from understanding the raw impact of TE in isolation. The current study therefore sought to investigate the effects of TE in a non-conflated design in order to elucidate what dependent variables need to be considered when designing TE studies or pedagogy by asking the following:

1. What are the relative effects of two forms of TE on the acquisition of third-person singular /~s/ and /~es/ among Japanese tertiary students?
2. Does participants' English proficiency affect the success/failure of the TE techniques and if so, to what degree?
3. How effective were the two forms of TE at triggering conscious noticing of the target?

3. Study design

3.1. Participants

The study was conducted at a small, private university with a focus on industrial sciences, located in rural Japan. A total of 408 participants initially responded to recruitment efforts, composed of first-, second-, and third-year students (18—20 years old). However, 26 participants were excluded retroactively for failing to attend one or more of the treatment sessions, resulting in a sample of $N = 382$. The participants were overwhelmingly male (M = 95.3%, F = 4.7%) and entirely composed of Japanese nationals with no history of living in any other country.

Students at this university are divided into English classes based on their performance on annual TOEIC® (Test of English for International Communication) Bridge tests, abridged to include only listening and reading sections (100 questions). The scores of these two sections are combined, resulting in an aggregate score representing the students' comprehension abilities. The four levels, with their Common European Framework of Reference for Languages (CEFR) equivalents, are: High (B1 and above), Medium (A2 to B1), Low (A2), and Basic (A1 and below). Recruitment was conducted only from the two middle levels, as the High levels contain several exceptional students, and non-Japanese students who are near-native English speakers. Given that these students would likely score nearly perfectly on the pretest, there would be limited value in including them in the study. Similarly, the Basic classes have many students who scored less than 50% on the placement test, including submissions made in bad faith (e.g., blank marksheets or with the same answer checked for every question). It was deemed unlikely that such participants would seriously engage in the study, potentially introducing issues of internal validity.

3.2. Methods and materials

3.2.1. Assessment and treatment timing

The participants were first indexed based on English proficiency (Medium or Low) and then further divided into four groups via stratified random sampling: a true control group which received no treatments (CTRL; $n = 88$), a comparison group which was given unenhanced texts (COM; $n = 96$), and two experimental groups (COL; $n = 96$ and SIZE; $n = 102$; details to follow in Section 3.2.4). Meeting sessions were established at the university's self-access learning center (e.g., 1−2:00pm was reserved daily for CTRL members, 2−3:00pm for COM, etc.). Participants choose their starting day within a one-week period, at which time they took the pretest, followed by Treatment One. Exactly one week later, they were required to return for Treatment Two, the posttest, and the exit interview. Due to the large sample and number of groups, students were instructed to refrain from speaking with anyone regarding the study for the two-week duration of the experiment. In addition, the possibility of cross-group discussion was considered low, as participants came from different grade levels and academic departments throughout the university, with little commonality between them.

3.2.2. Targeted linguistic form

The target form was the English third person, which, in the singular form, requires the addition of the morphemes /~s/ or /~es/. This form was selected as it is one of the later forms that language learners tend to acquire due to its redundancy (Ellis, 1994; Makino, 1980) and has no corresponding morpheme in Japanese, thus negating L1 influence on the order of acquisition (Murakami & Alexopoulou, 2016). This form is part of the national English curriculum for Japanese students at Grade 7, though despite this, mastery in spontaneous production is rare, particularly at the proficiency level of the participants.

3.2.3. Outcome measures

To assess the degree of acquisition of the target form, two equivalent 30-item grammaticality judgement tests (GJT) were created. Ten distractor items were not graded, resulting in a maximum of 20 points (five grammatical and 15 ungrammatical prompts). Possible responses were "grammatical", "ungrammatical", and "unsure". Ungrammatical items focused on subject-verb agreement and the presence/absence of /~s/ and /~es/ (e.g., **The library close today at 5:00 pm; *Tom and my brother goes to karaoke every day*).

3.2.4. Experimental materials

Two short, graded passages were created for the treatment materials (89 words and 84 words, respectively; see Appendix A). The passages related the daily activities of two individuals, written in a casual style that the participants were accustomed to. Tokens conformed mostly to the New General Service List (Browne, 2014), Level 3 (intermediate). The target form was embedded 13 times in Treatment One (14.6%) and 12 times in Treatment Two (14.3%).

For COL, the text was enhanced by underlining each instance of the third-person morphemes /~s/ or /~es/ and changing the font color to red (see Appendix B). The enhancement for SIZE consisted of doubling the font size for each third-person singular verb (Appendix C). Previous studies have typically only compared a single form of TE versus unenhanced text or input flooding. As a result, there has not been much discussion about the relative benefits of different types of enhancements compared to each other, representing a novel contribution of the current study to the literature. These two selected techniques not only differ visually, but the enhancement for COL pinpoints the /~s/ and /~es/ allomorphs while SIZE highlights the entire verb.

Two basic reading comprehension quizzes were administered after the students read each treatment passage. These quizzes were comprised of seven items, written in Japanese, which were a combination of free response, true-or-false, and multiple-choice items (e.g., *Where does Nick eat lunch every day?; Nick lives alone, true or false?* etc.). Students were told to respond in Japanese as well, to eliminate any form of production practice of the target form. Again, the purpose here was twofold. First, it was an important control measure to ensure that participants were properly reading the text passages from beginning to end. If any participant incorrectly answered more than one item, they would have been excluded from the data analysis. However, this was not found to be an issue and it can be therefore be stated that all participants properly engaged in the reading tasks. The second purpose of the comprehension quiz was to draw the students' attention toward the content of the passages, and not the linguistic form (VanPatten, 1985, 1990), in order to test the efficacy of the IE techniques at competing for processing capacity.

3.2.5. Quantitative and qualitative data collection

At the first meeting, participants were given 10 min to complete the pretest. Students were encouraged to answer the questions as quickly as possible, based on their first impressions of the grammaticality of each item. After this, students (excluding CTRL) were presented with the first reading and told to study it for 5 min, after which they would be given a comprehension quiz. Students retained the reading passage during the quiz and could review it to search for the correct answers if necessary. The following week, the second reading passage was distributed for 5 min, followed by the comprehension quiz in the same manner. Once the quizzes were complete, the posttests were conducted with the same 10-min time limit.

Participants were then immediately interviewed in Japanese by the researcher, or one of the other self-access center staff, regarding their cognition of the purpose of the study. This allowed for the qualitative examination of participants' experience

of the treatment procedures to add depth to the interpretation of the quantitative data (for more on mixed-method research, see Creswell & Creswell, 2018; Creswell & Plano Clark, 2007). Students were asked:

1. Were you aware of what grammar form was being investigated?
2. If 'yes', what grammar form do you think was being investigated?

They were then shown the text they had previously viewed, and asked:

3. What do you notice about your group's text?

4. Results

4.1. Overall results

Datasets were created using IBM's Statistical Package for the Social Sciences (SPSS) software, Version 24. All statistical calculations were performed using this software. Descriptive statistics (*M* and *SD*) were calculated, as reported below (Table 1).

All four groups were very close in participant size, and a Brown-Forsythe test showed that the homogeneity of variance for pretest scores at the start of the experiment were equal, $F = 1.67$, $p = .17$. However, Shapiro-Wilk tests indicated that only the scores for group SIZE were in a normal distribution. The other groups' scores were distributed non-normally (see Table 2).

Although *t*-tests and analysis of variance (ANOVA) are parametric tests, which assume a normal distribution, it has been suggested that they are robust enough to use with non-normal data, particularly with sample sizes larger than $N = 50$ (Glass, Peckham, & Sanders, 1972; Harwell, Rubinstein, Hayes, & Olds, 1992; Lix, Keselman, & Keselman, 1996). As all groups were significantly larger than the suggested minimum threshold, parametric tests were considered appropriate for the analysis of variance and *t*-distribution (i.e., means). ANOVA was therefore run to compare the four groups' pretest scores, with results indicating that there was no significant difference at the $p < .05$ level [$F(3, 378) = 1.66$, $p = .18$].

In order to formally address RQ1 concerning the relative effects of the two forms of TE over time, a split-plot ANOVA was conducted to compare group gain scores from the pretest to the posttest. The differences across groups was found to be statistically significant, with group membership explaining 24% of the variance in change scores [$F(3, 378) = 3.04$; $p = .03$; $\eta^2 = 0.24$]. The relative size of the gains for each of the four groups between pre- and posttest was calculated via paired samples *t*-tests, the results of which are displayed below in Table 3.

Effect sizes expressing the standardized mean difference (*d*) for all gains experienced by each group were also calculated (Table 4) to elucidate magnitude differences between groups, although it should be noted that only gains for COL and SIZE were statistically significant (i.e., $p < .05$).

The study showed that while both experimental groups (COL and SIZE) showed slight but significant gains between pretest to posttest, both control (CTRL) and comparison (COM) groups showed no evidence of acquiring the target feature, with confidence intervals falling on both sides of zero ([-.71, .30] and [-0.50, 0.52], respectively). The likelihood of gains shown by COL and SIZE being attributed to practice effects can therefore be dismissed. While COL showed a slightly higher effect than SIZE ($d = 0.23$ vs. 0.14) in reference to CTRL, both effect sizes are considered small by L2 field-specific benchmarks (Plonsky & Oswald, 2014).

4.2. Analyses of the effect of proficiency on noticing

Similar analyses were then conducted on the data after dividing the dataset based on the English proficiency variable to address RQ2 concerning the effect of English proficiency on the success/failure of the TE techniques. This resulted in an A (higher) and a B (lower) subset for each of the four groups (Table 5). The relative size of gains for each of the eight groups between pre- and posttest were calculated via paired samples *t*-tests, the results of which are displayed below in Table 6.

Again, effect sizes expressing the standardized mean difference (*d*) were calculated and are reported in Table 7, though only effect sizes for COL (A and B) and SIZE-B were statistically significant.

Table 1
Descriptive statistics.

Group	Pretest		Posttest	
	M	*SD*	*M*	*SD*
CTRL ($n = 88$)	10.93	2.38	11.14	2.97
COM ($n = 96$)	11.87	4.15	11.86	4.52
COL ($n = 96$)	11.78	2.72	12.67	3.06
SIZE ($n = 102$)	11.59	2.98	12.37	3.41
Total ($N = 382$)	11.56	3.15	12.03	3.58

Note. CTRL = control; COM = comparison (plain text); COL = color and underline enhancements; SIZE = font size enhancements.

Table 2
Shapiro-wilk normality of distribution output.

Group	Pretest			Posttest		
	Statistic	*df*	*p*	Statistic	*df*	*p*
CTRL	.23	88	<.001*	.17	88	<.001*
COM	.15	96	.001*	.12	96	<.005*
COL	.19	96	<.001*	.15	96	.01*
SIZE	.12	102	.06	.09	102	.13

Note. * indicates rejection of the null hypothesis, i.e., data is non-normally distributed.

Table 3
Descriptive and inferential statistics for gain scores (pretest to posttest).

Group	*M* (*SD*)	95% *CI*	*t*	*p*	*d*
CTRL	-.21 (2.40)	[-.71, .30]	-.80	.43	.07
COM	.01 (2.54)	[-.50, .52]	.04	.97	.00
COL	-.89[a] (2.58)	[-1.41, −.36]	−3.36	.001	.30
SIZE	-.78[a] (2.30)	[-1.24, −.33]	−3.44	.001	.24

Note. CTRL = control; COM = comparison (plain text); COL = color and underline enhancements; SIZE = font size enhancements.
[a] Indicates significance at the <.05 level.

Table 4
Effect sizes (d) for Contrasts Across Pre-Post Gain Scores.

Group	CTRL	COM	COL	SIZE
CTRL	–	–	–	–
COM	-.07	–	–	–
COL	.23	.30	–	–
SIZE	.14	.24	-.06	–

Note. d values here refer to standardized mean differences. The group on the horizonal axis is the 'reference' group. Positive values can therefore be understood as indicating a higher score for the group in the far-left column.

Table 5
Descriptive statistics (divided by English proficiency).

Group	Pretest		Posttest	
	M	*SD*	*M*	*SD*
CTRL-A ($n = 45$)	11.27	2.75	11.73	3.31
CTRL-B ($n = 43$)	10.58	1.89	10.51	2.45
COM-A ($n = 49$)	12.16	4.04	12.14	4.27
COM-B ($n = 47$)	11.57	4.28	11.57	4.79
COL-A ($n = 48$)	11.73	2.66	12.81	3.12
COL-B ($n = 48$)	11.83	2.82	12.52	3.02
SIZE-A ($n = 51$)	11.41	3.02	11.86	3.04
SIZE-B ($n = 51$)	11.76	2.95	12.88	3.71
Total-A ($n = 193$)	11.65	3.17	12.14	3.47
Total-B ($n = 189$)	11.47	3.13	11.93	3.70

Note. A = higher level; B = lower level of proficiency.

Table 6
Descriptive and inferential statistics for gain scores (pretest to posttest).

Group	*M* (*SD*)	95% *CI*	*t*	*p*	*d*
CTRL-A	-.47 (2.61)	[-1.25, .32]	44 (-1.20)	.24	.15
CTRL-B	.07 (2.15)	[-.59, .73]	42 (.21)	.83	-.03
COM-A	.02 (2.70)	[-.75, .80]	48 (.05)	.96	.00
COM-B	.00 (2.39)	[-.70, .70]	46 (.00)	1.00	.00
COL-A	−1.08[a] (2.94)	[-1.94, −.23]	47 (-2.56)	.01	.37
COL-B	-.69[a](2.19)	[-1.32, −.05]	47 (-2.18)	.03	.24
SIZE-A	-.45 (2.51)	[-1.16, .26]	50 (-1.28)	.21	.15
SIZE-B	−1.12[b] (2.05)	[-1.69, −.54]	50 (-3.90)	<.001	.31
Total-A	-.49[a] (2.70)	[-.88, −.11]	192 (-2.53)	.01	.15
Total-B	−46[a] (2.23)	[-.78, −.14]	188 (-2.84)	.005	.13

Note. A = higher level; B = lower level of proficiency.
[a] Indicates significance at the <.05 level.
[b] Indicates significance at the <.001 level.

Table 7
Effect sizes (d) for Contrasts Across Pre-Post Gain Scores.

Group	CTRL-A	COM-A	COL-A	SIZE-A	CTRL-B	COM-B	COL-B	SIZE-B
CTRL-A	–	–	–	–				
COM-A	-.15	–	–	–				
COL-A	.22	.37	–	–				
SIZE-A	.00	.15	-.22	–				
CTRL-B					–	–	–	–
COM-B					.03	–	–	–
COL-B					.27	.24	–	–
SIZE-B					.34	.31	.08	–

Note. d values here refer to standardized mean differences. The group on the horizonal axis is the 'reference' group. Positive values can therefore be understood as indicating a higher score for the group in the far-left column.

Not surprisingly, group membership did not show any significant effects for either group CTRL or COM, with statistical significance, confidence intervals, and effects sizes all negligible. However, the results from groups COL and SIZE showed an interesting trend. While both A and B subsets of COL showed small, but significant, increases in relation to their CTRL counterparts ($p = .01$, $d = 0.22$ and $p = .03$, $d = 0.27$ respectively), the A subset of SIZE did not increase significantly while the B subset did, with a small effect size ($p = .21$, $d = 0.00$ and $p = .001$, $d = 0.34$, respectively), suggesting that enlarging the text of target verbs was not effective at triggering noticing for more proficient learners. Whether this result could be observed using the same TE technique on a different target feature is a topic for future investigations.

4.3. Results of the post-assessment interviews

The responses obtained from each of the three interview questions were indexed and reported below. When asked if they were aware of what grammar form was being investigated in the current study, 111 (29.06%) participants responded affirmatively (Table 8), though this was skewed heavily towards members of the A-subsets ($n = 78$; 70.27% of affirmative respondents).

However, caution is needed when considering the implications of these results. As can be seen in Table 9, the responses to Question 2 indicated that a large portion of those students who answered affirmatively to Question 1 were erroneous in their assumptions ($n = 49$; 44.14% of affirmative respondents). The most reported misconception was that the study was concerning the English plural tense, indicating some degree of awareness of the significance of the /~s/ and /~es/ allomorphs, albeit at a very shallow depth of processing. (Remember that all students demonstrated satisfactory comprehension of the texts on subsequent comprehension quizzes.) It should also be noted that the largest incidence of misconception was observed in the comparison group COM who were provided with plain text without the benefit of textual enhancements. Surprisingly, even though SIZE-A had the highest number of participants correctly noticing the target form in the text ($n = 19$; 37.25% of SIZE-A), they were the only experimental group to not show any statistical increase in mean scores from pre-to posttest.

For the final interview question, each group (excluding CTRL) was shown the treatment materials that were used in their lessons and asked to quickly report anything they noticed about it in a think-aloud protocol. Participants spoke freely and were told to say, "Finished" when they had nothing more to say. Responses were indexed based on accurate mention of the target form; non-mentions or discussions of other features were categorized as *other* (see Table 10, below).

Predictably, the number of instances of participants noticing the target feature were higher than in response to Question 2. Naturally, every participant who thought the study was concerning third-person /~s/ would report noticing it in the think-aloud protocol. What is more interesting are those participants who noticed the target form but did not make the connection that it was salient for the purposes of the current study. Many students commented on the content of the passages (e.g., expressing wonder at why Nick woke up so late, or why Zoe went to sleep so early), giving strong evidence that their working memory was actively engaged in processing for meaning, not form. However, it is also possible that those students noticed the target form but for a variety of possible reasons, did not report it.

Table 8
Responses to Question 1 (Were you aware of what grammar form was being investigated?).

	Group								
	CTRL		COM		COL		SIZE		
	A	B	A	B	A	B	A	B	Total
Yes	3	2	35	13	12	9	28	9	111
No	42	41	14	34	36	39	23	42	271
N	45	43	49	47	48	48	51	51	382

Table 9
Responses to Question 2 (What grammar form do you think was being investigated?).

	Group								
	CTRL		COM		COL		SIZE		
	A	B	A	B	A	B	A	B	Total
Target	3	2	13	1	9	6	19	9	62
Other	0	0	22	12	3	3	9	0	49
N	3	2	35	13	12	9	28	9	111

Table 10
Responses to Question 3 (What do you notice about your group's text?).

	Group								
	CTRL		COM		COL		SIZE		Total
	A	B	A	B	A	B	A	B	
Target	–	–	14	1	14	12	33	22	96
Other	–	–	35	46	34	36	18	29	198
N	–	–	49	47	48	48	51	51	294

5. Discussion

This study sought to determine the relative effects of two forms of textual IE on Japanese university students' acquisition of the English third-person form. The results showed, first, that both TE treatments resulted in significant, though small, gains as measured by GJTs. These results generally align with findings that positive effects of TE, when found, are small (e.g., Alanen, 1995; Jourdenais, Ota, Stauffer, Boyson, & Doughty, 1995). Furthermore, the study demonstrated that English proficiency is an important variable to consider when conducting TE research. In general, the lower-proficiency experimental groups showed greater degrees of improvement over their respective control groups than their counterparts of higher proficiency (see Table 7), perhaps following Shintani et al.'s (2013) proposal that perception-based training is more effective for teaching new features (while explicit production-based training is better for consolidating features already partially acquired). This assertion is somewhat bolstered by the results of post-interviews, which revealed that while the higher-level participants in all groups accurately identified the target form in the enhanced text to a greater degree than their counterparts (Table 9), the lower-level groups exposed to TE showed greater degrees of improvement overall (Table 7).

However, post-assessment interviews elucidated that most participants were not led to a conscious awareness of the target feature, a first step that Schmidt (1990) asserted was necessary for acquisition. This issue of validity should be considered when interpreting TE studies which do not contain qualitative elements, such as those which solely employ objective measures of attention such as eye-tracking. The fact that many participants derived an incorrect meaning behind the enhancements reveals that increased physical direction/duration of the visual space on the area of interest does not necessarily equate to noticing of the target feature.

A comparison of the effects of different TE techniques also found counterintuitive findings. While a greater number of individuals reported noticing the target feature with SIZE versus COL enhancements ($n = 55$ vs. $n = 26$, respectively) (Table 10), the COL group slightly outperformed SIZE overall ($d = 0.30$ vs. $d = 0.24$) (Table 4). This apparent contradiction might possibly be attributed to the need for more time before noticed features can become consolidated in the interlanguage. Future research should consider prolonging the duration of data collection, although there is currently no consensus as to how long the consolidation phase may last (Fotos, 1993). Conversely, it may be that the depth of processing (Leow, 2015) was insufficient for retention (i.e., subsequent internalization) and that noticed features were quickly dropped from working memory.

5.1. Pedagogical implications

Based on the results, it would seem that TE, employed in isolation, was effective at inducing some level of noticing/acquisition of the target form when compared to comparison or control groups. However, the small effect sizes observed, and the overall lack of noticing elucidated by the post-interviews, suggest that there is large room for improvements which may amplify the efficacy of the methodology. For example, even the process conducted here, asking students to explicitly iterate what they noticed, is theorized to improve the efficacy of the TE methodology in the future. This stems from the observation that provision of explicit instructions for students to attend to the enhanced forms is linked to improved performance, as described previously in the literature review (Section 2.3), possibly by deepening their processing of the stimulus (e.g., Leow, 2015). Ideally, students should be educated as to the importance of noticing and encouraged to take an active role in their own learning experience. Particularly in Asian contexts, learners tend to be more passive (Rees-Miller, 1993) and require training in active learning strategies in order to become adept at them (Pennycook, 1997). Consequently, increased learner autonomy not only aids noticing, but it has also been linked with improved motivation (Deci, Vallerand, Pelletier, & Ryan, 1991).

5.2. Limitations and future directions

This study attempted to address some common criticisms of TE and research into noticing by using a mixed-method design that included post-assessment interviews. The purpose of the interviews was to ascertain if the enhancements were successful at drawing participants' conscious attention to the target features, the answer to which generally appears to be 'no', as 70.71% of the participants in the experimental groups reported not being aware of the grammar form investigated (Interview Question 1), and 59.09% did not verbalize noticing the target form during the think-alouds (Interview Question 3). It is possible that the proficiency level of the participants was too low, or the selected target feature was too morphologically redundant and thus, non-salient (see Section 3.2.2). It would therefore be beneficial to reexamine the study using a more novel target form, particularly one with which participants had significantly less prior knowledge (as evidenced by the pretest scores of all groups being already over 50%; see Table 1). Likewise, future studies could benefit from investigations into whether the variables examined here (i.e., TE technique, target form, and language proficiency) are found to impact not only noticing, but depth of processing, which is believed to be a greater predictor of eventual acquisition (Leow, 2015).

Another possible limitation regarding the qualitative data collection was that it was not conducted concurrently to the first exposure (i.e., online), but after the experiment was completed (i.e., offline), whereby issues of memory decay (Leow, 2015) or double exposure to the target (Bowles, 2019) may have become factors.

One salient observation is that a few members of CTRL accurately inferred the target feature and purpose of the study just by participating in the pre- and posttests. In addition, a few members of the COM were able to do the same, even in the unenhanced condition. In both cases, it is likely that the frequency of the target was enough to trigger noticing, although it is unknown how this might have influenced the results. It is also possible that the comprehension quizzes provided further exposure to the target form. Future research may benefit from assessment or comprehension measures that are not as intrusive as the current study's methods.

6. Conclusion

Scholars in various domains have investigated the role that perception (i.e., noticing) plays in SLA (e.g., pronunciation: Best, 1994; Flege, 2005; vocabulary: Norris & Ortega, 2000, 2001; listening comprehension: Lee, 2020). To examine the generalizability of perception-based instruction, the current study examined the relative effectiveness of two forms of textual enhancements on the acquisition of the English third-person /~s/ and /~es/ among 382 Japanese university-level EFL (English as a Foreign Language) students. The results suggested that both forms of IE were effective at triggering statistically significant acquisition of the target, albeit with a small effect size. A further examination of the data, taking into account the variable of English proficiency, indicated that students of lower proficiency showed greater improvement over their corresponding control groups than their peers of higher proficiency did, a finding that deserves further investigation in the future. It is recommended that TE techniques not be used in single doses, or in isolation, due to their small effect, but in tandem with learning strategy training designed to increase students' awareness of the opportunities for learning which present themselves both in- and outside the classroom.

CRediT authorship contribution statement

Bradford J. Lee: Conceptualization, Methodology, Formal analysis, Investigation, Resources, Writing - original draft, Writing - review & editing, Funding acquisition.

Declaration of competing interest

None.

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Appendix B. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.system.2020.102407.

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