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Stand-out: A Systematic Review of the Role of Salience in Second Language Acquisition

SYSTEMATIC REVIEWS AND META-ANALYSES

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ABSTRACT

Salience is frequently cited as a post-hoc explanation of results in second language acquisition (SLA) research. However, how salience is operationalized varies considerably and empirical investigations into the causal effect of salience are sparse. This systematic review analyzes studies that manipulated theorized salience manifestations in second-language contexts toward three primary objectives: (1) to provide an overview of how salience has been empirically operationalized in SLA research, (2) to synthesize existing findings on the impact of salience on second-language learning, and (3) to identify gaps in the current literature to guide future research toward a more comprehensive understanding of salience and its role in second-language acquisition. We extracted 473 references from the Web of Science and Scopus databases, retaining 42 studies for detailed analysis. Results indicate a positive relationship between higher levels of salience and second-language learning outcomes. Findings also show remaining gaps regarding isolated salience manifestations in general and psycholinguistic manifestations in particular.

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1. INTRODUCTION

The notion of linguistic salience—the degree to which a linguistic element stands out from its environment (Ravid, 1995)—has been studied in numerous linguistic subfields (cf. Boswijk & Coler, 2020). However, its role in second-language (L2) acquisition remains little understood. In their volume dedicated to salience in SLA, Gass et al. (2017a) provided the first (and arguably thus far the only) comprehensive discussion of salience as it applies to L2 acquisition specifically. Gass et al. (2017b) delineated two overarching questions that are key to understanding salience in the field of second language acquisition (SLA):

1. What makes a feature of L2 input salient?
2. How does salience impact the acquisition process?

From a theoretical standpoint, these questions have led to much discussion but little consensus about the nature of linguistic salience and its role in L2 acquisition. Meanwhile, although empirical research on the subject has increased in recent years, the resulting body of findings has not been considered in a sufficiently systematic way to understand what such results tell us about salience in L2 acquisition. In the first attempt to address this gap, we present a systematic review that compiles empirical studies on salience in SLA. This review aims to synthesize existing findings and identify remaining gaps in the literature. Additionally, we seek to better relate these empirical findings to the current theoretical landscape and guide future research toward a more comprehensive understanding of salience in SLA.

2. SALIENCE AND ITS ROLE IN L2 ACQUISITION

Although the notion of salience was implicitly and sometimes even explicitly referred to in various theoretical SLA publications in the 1980s and 1990s (e.g., Long, 1996; Sharwood-Smith, 1981), it gained real prominence on the SLA research agenda when Goldschneider and DeKeyser (2001) proposed salience as the single most important factor to account for the orders of morpheme acquisition. Thereafter, salience has frequently been invoked as a key determinant of L2 learners' initial input processing and learning, particularly in relation to the cognitive mechanisms of attention and awareness in L2 acquisition (cf. Section 2.2). However, for salience to have any relevance for a theory in SLA, it must be defined as an independent construct, which has proven challenging. In the following subsections, using Gass et al.'s (2017b) general questions as a guiding framework, we discuss the various ways salience has been defined and categorized generally and in the field of SLA, how these categorizations might manifest in real-world L2 input, and what impact salience is believed to have on L2 development.

2.1. WHAT MAKES A FEATURE OF L2 INPUT SALIENT?

In the field of psychology, Taylor and Fiske (1978) defined salient information as what most readily enters the cognitive system in a given moment. Higgins (1996, p. 133) delineated three types of property influencing this effect: "properties of stimuli" (i.e., an entity's physical characteristics), "properties of situations" (i.e., the context in which the entity is situated), and "properties of perceivers" (i.e., how the entity relates to the observer's prior experience). Linguistic features might stand out to a learner in similarly varied ways. For instance, stressed L2 forms are expected to be more salient than unstressed forms (stimuli-related), but forms might also stand out due to semantic or pragmatic value (situation-related) or as they relate to the learner's linguistic background (perceiver-related).

Such broad categorization of salience properties exemplifies a key challenge of salience as a construct and research thereabout, namely that "salience is one of those concepts that escapes easy description or definition" (VanPatten & Benati, 2010, p. 143). Indeed, the Gass et al. (2017a) volume alone included three different categorizations of the possible types of salience. First, Gass et al. (2017b) differentiated between bottom-up (or perceptual) salience, and top-down (or constructed) salience. According to their categorization, perceptual salience manifests via properties inherent to the form itself (they also referred to this as intrinsic salience). Constructed salience, meanwhile, refers to salience manifesting from any of numerous possible external factors, including the learner's cognitive processes, the learning context, and/or input enhancement (e.g., highlighting or bolding of target forms). Second, Ellis (2017) delineated

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three salience categories: Psychophysical, which roughly equates to Gass et al.'s (2017b) perceptual category; association, wherein salience of a form arises via its importance within our own experience; and surprisal, wherein salience arises from a form's unexpectedness in a given context. Finally, DeKeyser et al. (2017) stratified definitions of salience into three tiers, based upon what types of salience the definition includes: 1) Narrow, wherein salience is defined only according to a form's physical properties; 2) medium, which incorporates both physical properties and properties that relate to the form's linguistic context but does not extend to extra-linguistic factors; 3) wide, which includes the above two categories along with properties related to a learner's experience (Spinner et al., 2017, related this to Gass et al.'s (2017b) constructed salience later in the volume).

For the purpose of the current article, we propose our own categorization for manifestations of salience, with inspiration from the linguistic categorizations described above and from Higgins' (1996) psychological salience types. A notable difference from these other categorizations is that we focus only on salience that manifests in ways that can be related back to the linguistic form—in other words, intrinsic salience. However, this salience is not only intrinsic to the form itself but also to the form in relation to the overall linguistic environment in which it is embedded. As a result, our focus includes some aspects of Gass et al.'s (2017b) constructed salience category, which we explain further below. We do this because we are interested in how salience arises naturally during the acquisition process, rather than entirely subjectively (i.e., association category in Ellis, 2017) or by way of strictly extralinguistic influences (i.e., many [but not all] of the constructed category in Gass et al., 2017b, such as form-focused instruction [FFI]). We exclude subjective salience manifestations because they are very difficult—often even impossible—to quantify in order to study any effect they may have on the acquisition process. We exclude extralinguistic influences because these could be applied to any form in the input, whereas we are interested in properties intrinsic to the input itself, stemming from a form's own characteristics, its context, or the learner's linguistic experience with it.

After excluding these factors, our categorization largely equates to DeKeyser et al.'s (2017) three definition levels and is stratified according to Higgins' (1996) psychological categorization, as follows:

- Perceptual salience: Salience manifests via a form's physical properties (similar to Gass et al.'s, 2017b, perceptual salience and in part Ellis's, 2017, psychophysical categorization; cf. properties of stimuli, Higgins, 1996)
- Psycholinguistic salience: Salience manifests via the relationship between a form and its linguistic context (cf. situational properties, Higgins, 1996)
- Experiential salience: Salience manifests via the relationship between a form and the learner's linguistic experience (cf. properties of perceivers, Higgins, 1996)

Figure 1 depicts our categorization of linguistic salience, with reference to DeKeyser et al.'s (2017) three definitions.

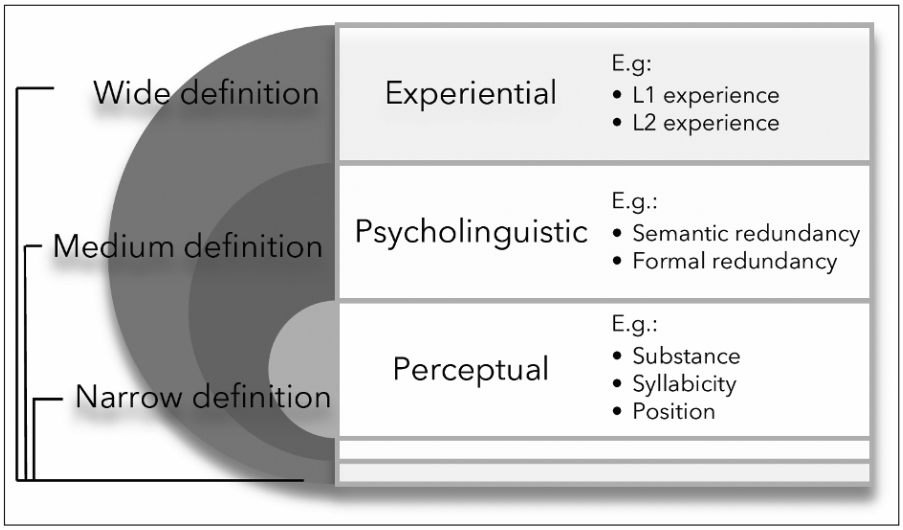

Figure 1 Salience categories proposed by DeKeyser et al. (2017).

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Within each category are numerous properties that have been theorized to affect salience. The first category, perceptual salience, includes salience manifestations determined by a form's physical properties (Sharwood-Smith, 1994). These (non-exhaustively) include:

- Substance: The number of phones or letters a form contains, where longer forms are assumed more salient than shorter (e.g., Streefkerk, 2002);
- Syllabicity: Where (more) syllabic forms are assumed more salient than non-/less-syllabic forms in oral input (e.g., de Jong, 1995);
- Boundedness, where free morphemes are assumed more salient than bound ones in written input (e.g., Giraudo & Dal Maso, 2016);
- Position in a word (bound morphemes) or sentence (free morphemes), where forms at the beginning or end of a word/sentence are assumed more salient than those in the middle (DeKeyser, 2005; Goldschneider & DeKeyser, 2001).

The second category, *psycholinguistic salience*, includes manifestations determined by the impact of the linguistic context on the salience of the target form. For example, according to the primacy of meaning principle (VanPatten, 2004), learners process input for meaning before form, which can reduce the salience of grammatical forms regularly accompanied by semantically redundant lexical forms. Temporal adverbs, for instance, often appear with inflectional tense morphemes, allowing learners to overlook inflections without losing semantic content, diminishing their salience (Ellis, 2017). Psycholinguistic salience might also manifest in formal transparency, or using Ellis' (2006, 2022) terms, contingency of the relationship between form and meaning (e.g., the form's homonymy or allomorphy). For example, in English, the inflectional morpheme *-s* is homonymous for third-person singular verb tense, plurality, or genitive. It also has several allomorphs (/s/, /z/, /ɪz/), depending on its phonological context. Lack of contingency diminishes the form's uniqueness within the input and might obscure the mapping of meaning/function to form, both potentially reducing salience (see also DeKeyser, 2005).

The third category, experiential salience, includes manifestations determined by the relationship between the learner's prior experience with their first language (L1) or the L2 and the salience of an L2 form. According to associative learning theory (e.g., Ellis, 2006), acquiring one cue in association with a particular outcome hinders the learning of different cues for that outcome (i.e., blocking). Consequently, having developed associations between particular forms and their meanings as part of L1 acquisition, a learner is expected to attend more readily to aspects of L2 input that resemble their L1 (learned attention). Thus, the mechanisms developed during L1 acquisition are expected to affect the salience of L2 forms for the learner (see also Slobin, 1985).

Experiential salience related to L2 experience manifests in the frequency of encountering a form in L2 input. However, despite claims that "frequency of a morpheme *obviously* contributes to its salience," (Goldschneider & DeKeyser, 2001, p. 36, emphasis added), its relationship to salience and resulting effect on L2 acquisition are particularly multifaceted. Goldschneider and DeKeyser (2001) predicted (and found) that greater frequency would positively correlate with ease of acquisition, suggesting that salience increases with frequency. Probabilistically, in early stages of L2 learning, greater frequency of a form tends to increase the likelihood the learner will eventually attend to it, yielding greater salience. Also, when a form is noticed once, its salience likely increases the next time the learner encounters it (Higgins, 1996). However, in some contexts, frequency effects on attention and salience might reverse. According to many cognitive theories, the brain is a prediction machine, using probability to create expectations about the external world (Clark, 2013). Thus, that which occurs less frequently can yield surprisal, making it salient in its contrast to our expectations (Gass et al., 2017b). As Ellis (2017) noted, "we … have expectations about what is going to happen next in known contexts; we are surprised when our expectations are violated, and we pay more attention as a result" (p. 343). In Gass et al.'s (2017b) categorization, a salience effect due to high frequency falls under constructed salience, while a low-frequency effect falls under perceptual salience (see also surprisal category in Ellis, 2017). They further contended that high-frequency effects occur during early stages of learning, whereas low-frequency effects occur later. Because both frequency effects arise from how the learner's experience relates back to a given form, we include both as part of our categorization. Thus, while it indeed seems obvious that frequency affects salience, the direction of the effect likely varies according to context (see also Boswijk & Coler, 2020).

2.2. HOW DOES SALIENCE IMPACT THE ACQUISITION PROCESS?

Knowing what is salient to L2 learners is key to understanding the effects salience has on the L2 learning process. One primary way salience, in its myriad manifestations described above, is believed to impact acquisition is via its influence on attention and awareness. Attention can refer to any in a range of cognitive states wherein a perceiver is able to take in input from the environment (cf. Tomlin & Villa, 1994), but for our purposes, we use the term attention in reference to the selective allocation of cognitive resources to a discrete aspect of information while ignoring other perceivable information (see also Robinson, 2003, for an application of this definition in SLA). Attention to novel features in L2 input is considered necessary for their intake (initial, possibly temporary registration in short-term memory) and therefore to further processing and, ultimately, acquisition (Leow, 2015). The role of awareness in L2 acquisition is more controversial than attention, partially due to the difficulty of defining it. Broadly, awareness refers to an individual's subjective heightened experience, knowledge, or recognition of a stimulus. Awareness is closely related to consciousness (Schmidt, 2010), yet some argue that certain unconscious awareness is possible (e.g., Leung & Williams, 2012). Awareness is also critically linked to attention: Generally, what we attend determines what we become aware of, and what we are aware of can in turn affect what we attend (Gass et al., 2003; Higgins, 1996). One prominent theory emphasizing the importance of these phenomena in L2 acquisition is Schmidt's (1990, 2001) Noticing Hypothesis. Schmidt defines noticing as a state between attention to and awareness of a feature within L2 input, initiating intake. Thus, within this theory, noticing of L2 features is necessary for their acquisition. Because salience of an L2 feature is expected to increase the potential that the learner will attend to it, this makes salience an important aspect of L2 acquisition according to theories like the Noticing Hypothesis.

While attention suggests an external influence upon the cognitive system, salience is believed to manifest internally via its influence on the readiness of the cognitive system to select a given cue over competing cues. For example, when considering language chunks with multiple meanings, such as homonymous words (e.g., "right" can mean opposite of left or correct) or ambiguous idioms (e.g., "kick the bucket" can idiomatically mean the literal action "to die"), the most salient meaning will be the most readily accessed (Giora, 2003). Kecskes (2006) discussed this effect, noting that while the phenomenon will be the same for L2 learners, the degrees of salience of one cue versus another will likely differ from those of L1 speakers. Similarly, according to the Natural Morphology approach to complex word processing (e.g., Dressler et al., 1987), the relative salience of a stem, affix, or whole word is believed to underlie both the processing and mental lexical organization of complex words. Such concepts relate more generally to Ellis's (2006, 2022) discussion of contingency, associative learning, and their interplay with salience (see Section 2.1). In sum, salience is believed to impact learners' cognitive processes via both external and internal influences.

Because of its effect on cognitive processing of L2 input, salience is believed to contribute to the acquisition difficulty of L2 forms, defined as the amount of cognitive processing or effort and time required for their acquisition (Bulté et al., 2024). For example, Goldschneider and DeKeyser's (2001) meta-analysis on natural orders of English grammatical morpheme acquisition (e.g., progressive *-ing*) identified five possible contributing factors to the developmental timing of English morphemes:

1. Perceptual salience: Distinctiveness of a morpheme's physical properties, operationalized using three subfactors, which are substance (number of phones/letters), syllabicity (presence/absence of a vowel in the surface form), and sonority (see, for example, Laver, 1994);
2. Semantic complexity: Number of meanings a morpheme can express;
3. Morphophonological regularity: Degree to which morphemes are affected by their phonological context (e.g., allomorphy, contractibility, and redundancy);
4. Syntactic category: Whether the morpheme is lexical or functional, and bound or free;
5. Frequency: Total occurrences of the morpheme in the L2 input.

Together, these factors largely explained the natural orders observed across the analyzed studies. Goldschneider and DeKeyser (2001) then considered whether these factors were

analytically independent or shared a commonality and found that all five factors might impact a form's salience. They therefore concluded that "[i]t is possible … that just one variable, salience, is the ultimate predictor of the order of acquisition" (Goldschneider & DeKeyser, 2001, p. 36).

Based on these (largely theoretical) discussions of salience and its role in L2 acquisition, salience emerges as a potentially important latent construct whose composite nature might unify a set of seemingly disparate factors within L2 acquisition and relate them to cognitive processes therein such as attention and awareness. However, it is still unclear how salience manifests within L2 development. This is largely due to a lack of empirical research testing the many potential factors of linguistic salience as to whether and to what extent they influence a form's overall salience. Additionally, the relationships between different properties and their connection to the cognitive processes involved in L2 acquisition remain unclear. This systematic review acts as a first step toward addressing these gaps in our understanding of the concept of salience.

3. THE PRESENT STUDY

The previous section illustrates several challenges to understanding the concept of salience in the field of SLA. First, that any properties actually constitute salience manifestations is still largely theoretical, often relying on truistic expectations and/or research external to SLA. This means "[w]e still do not know what … makes a form more or less salient" (Graus & Coppen, 2015, p. 102). Moreover, how the relationship between salience and L2 outcomes is tested and measured can vary greatly, and not all methodologies adequately capture cognitive processes such that a relationship between these phenomena can be properly understood. Finally, there are numerous external factors that are likely related to salience, its manifestations, and its effects on learning outcomes, which must be considered to fully encompass the role of salience in L2 acquisition. To assess the extent to which these challenges have been addressed, this systematic review compiles and compares existing empirical studies on salience in SLA. It examines which theorized manifestations SLA researchers have linked to salience and identifies those that have been tested empirically. Additionally, it explores whether and how these factors have been found to influence L2 learning outcomes.

We aim to address four research questions:

1. How has salience been operationalized in empirical SLA studies? What theorized salience manifestations are represented empirically?
2. What methodologies have been employed to measure salience effects? What methodologies merit further exploration?
3. What effects of salience have empirical studies found on L2 acquisition?
4. What additional variables (AVs) have been considered alongside salience, and how do their effects interact with those of salience?

4. METHOD

4.1. SEARCH STRATEGY

We searched for relevant works in the Web of Science (WoS; https://www.webofscience.com) and Scopus (https://www.elsevier.com/solutions/scopus) databases. We focused on SLA publications that reported one or more empirical studies and used one or more salience manifestations described above as independent variables. Given the widespread use of the term salience in various academic contexts, our search was designed to maximize precision. We began with the query "salien* AND Second Language Acquisition" (June 6, 2022) in titles, keywords, and/or abstracts in the research areas linguistics, education, educational research, psychology, and communication, yielding 156 hits in WoS and 166 in Scopus. We later added "salien* AND L2," (December 13, 2022) using the same parameters, yielding 255 hits in WoS and 327 in Scopus. We set a lower publication year cutoff of 1990, demarcating the advent of the Noticing Hypothesis (Schmidt, 1990), given its influence on the recognition of salience as a potentially important factor in L2 acquisition. While we did not deliberately exclude unpublished literature, we prioritized peer-reviewed works to come as close to finding causation in the relationship between salience and L2 learning outcomes as possible.

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4.2. STUDY SELECTION PROCESS AND EXCLUSION CRITERIA

At every step, the first two authors determined the eligibility of each study. The articles were first analyzed for topic relevance, removing studies that were not SLA-related (either generally or if participants were native speakers, heritage learners, or from-birth bilinguals of the target L2). Given our specific interest in naturally occurring salience manifestations—those that arise in relation to properties inherent to L2 forms rather than externally applied (see Section 2.1.)—experiments that operationalized salience only through FFI (e.g., input enhancement) were also excluded.

Topic-relevant studies were then analyzed for empiricism, eliminating theoretical articles, reviews, and corpus studies. The remaining articles were analyzed for whether salience was treated as an independent variable. Studies that only applied salience as a possible post-hoc explanation of their results, but without empirically investigating a manifestation of salience, were accordingly excluded.

The two queries and databases yielded 904 publications total, of which eight were removed as they were published before 1990. Eliminating duplicates yielded 473 publications. Analysis for topic relevance eliminated 372 articles. Another 23 articles were excluded for lacking an empirical component. Finally, 36 of the remaining articles were eliminated due to lack of salience manipulation, yielding a final set of 42 articles included in this review (see Figure 2). Within these, 54 individual experiments meeting all inclusion criteria are discussed, across which 76 salience variables were manipulated. All analyzed publications and their annotations are available in the TROLLing database (Knell et al., 2025).

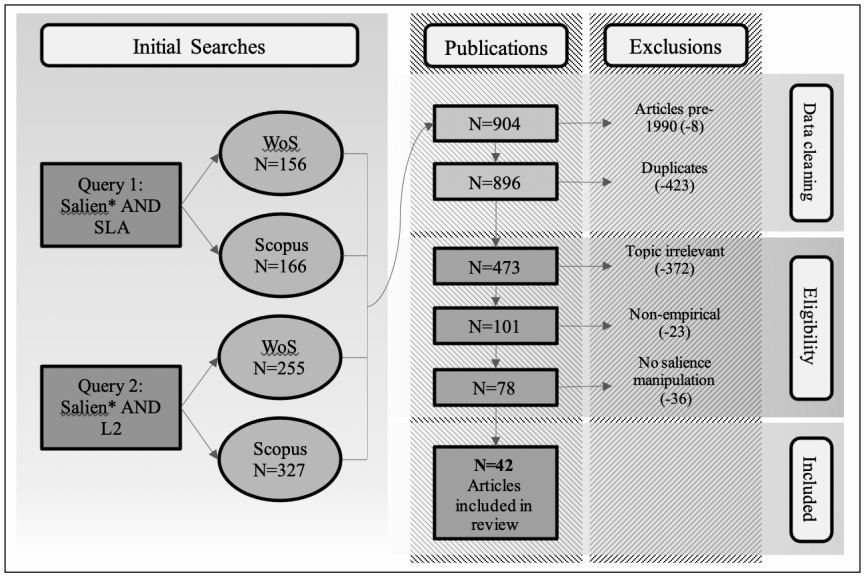

Figure 2 Eligibility analysis flowchart.

Note. WoS = Web of Science; SLA = Second Language Acquisition.

To illustrate the trend in research interest on this topic over time, Figure 3 shows the number of accepted articles by publication year per five-year block, beginning with 1998 (the earliest publication year in our sample). The figure indicates that interest in salience within SLA research has been increasing over the last few decades.

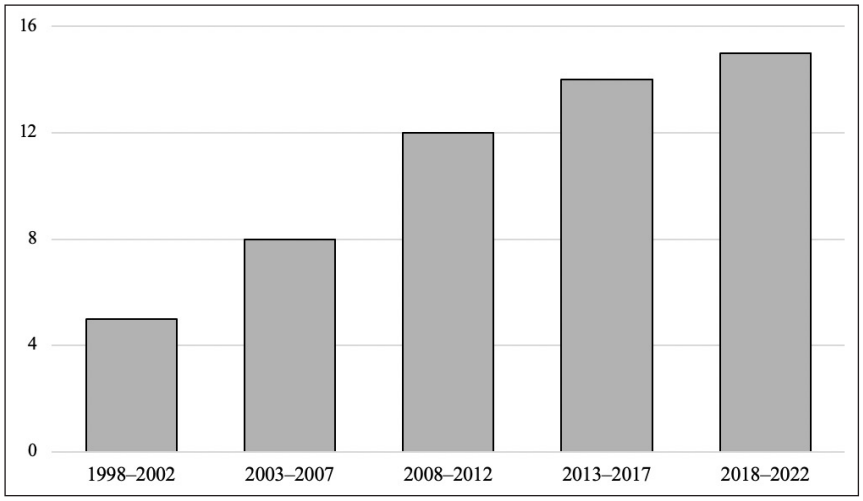

Figure 3 Number of articles included in sample by publication year.

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4.3. ACCEPTED ARTICLE ANNOTATIONS

Table 1 lists the variables for which each article was annotated.

SUBJECT	VARIABLES
Salience	• Operationalization(s): how a given salience manifestation was measured as an independent variable • Salience type (See Section 4.3.1.) • Salience effect (See Section 4.3.2.)
Participants	• Number • L1(s) • Target L2 proficiency: beginner, intermediate, and/or advanced as categorized by the study's authors
Treatment and outcome variable	• Target L2 • Learning outcome measures (aggregated by data type; see Section 5.3.) • L2 instruction type (if applicable)
AVs	• Other independent variables tested (e.g., proficiency, modality, learner variables) • Effect on results • How effects interact with salience variable(s)

Table 1 Annotated variables grouped by subject relevance.

The researchers' independent annotations were compared. Differences were discussed among the authors until an agreement was reached.

4.3.1. Categorizing salience

Each salience manifestation variable (MV) was categorized into the three types discussed in Section 2.1.: Perceptual (degree of salience [DoS] differs according to a form's physical properties, i.e., substance, syllabicity, position, boundedness, sonority, and stress), psycholinguistic (DoS differs according to the relationship between the form and its linguistic context, i.e., semantic value, semantic redundancy, and semantic and formal transparency), and experiential (DoS differs according to the relationship between the form and the learner's linguistic experience, i.e., [dis]similarity to their L1 or the frequency of exposure to an L2 form).

Frequency was problematic among possible MVs. In SLA research, frequency is often operationalized as logarithmic values within the L2. However, this presented two problems for our research. First, raw frequency was often discussed in the study corpus, but rarely in terms of salience. Inclusion of all studies that discussed frequency, regardless of its relationship to salience, would exceed the scope of the present review, being one of many manifestations under consideration. Second, raw frequency does not necessarily reflect learners' actual exposure to a feature, a persistent issue within SLA research (e.g., Gass & Mackey, 2002). How often a learner has encountered a target form is difficult to control experimentally, especially when using a natural language as the target L2, as most included publications do. Thus, in this review, frequency was only considered a MV if exposure frequency was experimentally controlled, such as frequency differences between forms in a [semi-]artificial language as the target L2. When raw frequency was present in an included article, it was treated as an AV rather than a MV.

While most variables fit into one of the three salience types, some studies conflated different salience manifestations into one variable. For example, several studies compared temporal adverbs and tense inflections, which differ both in perceptual properties (e.g., substance, boundedness, position) and psycholinguistic properties (e.g., semantic redundancy). In such cases, it is impossible to distinguish the effects of each salience type. Such variables were therefore categorized into a separate multiple-types group. Similarly, for perceptual salience, multiple individual manifestations are often conflated into a composite variable compared between forms. Consider again the numerous perceptual properties listed above according to which temporal adverbs differ from tense inflections. Unless the studies analyzed each property separately, one cannot parse the effect of the individual manifestations on the results. Thus, these variables were treated as a separate combination group when annotating operationalizations.

4.3.2. Defining salience effect

In line with theoretical literature discussed in Section 2.1., we define salience effect as a statistically significant learning effect on the outcome variable associated with salience. We distinguished four

types of salience effects based on a given experiment's results. First, a positive effect was a study that found a statistically significant positive relationship between the DoS and measured learning outcomes (LOs). Second, a mixed effect pertained to a study that found a positive relationship between the DoS and LOs, but only under certain conditions (e.g., in a subset analysis). Third, no effect pertained to a study that observed no statistically significant relationship between salience and LOs. Fourth, a negative effect was one in which a study found a negative relationship between the DoS and LOs. The only exception is frequency, as the DoS regarding frequency can vary by context. Thus, a frequency effect was considered positive if the direction of the effect matched the existing theoretical assumptions regarding probability versus surprisal.

4.4. DATA ANALYSIS

Analysis was primarily descriptive in nature. We conducted univariate and bivariate cross tabulations via the pivot table function in Microsoft Excel. Where prudent, a chi-square test was performed to calculate the significance of the results.

5. RESULTS

5.1. SALIENCE

We identified 76 individual MVs (Figure 4). Of these, 39% (n = 30) were perceptual, 34% (n = 26) experiential, and 11% (n = 8) psycholinguistic. Twelve variables (15%) included components from more than one category that were not individually analyzed ("Multiple" bar; see Section 4.3.1.). Within this group, all variables included a psycholinguistic component and either a perceptual (n = 11) or experiential (n = 1) component. Figure 4 also shows that in all categories, a significant majority (72%, n = 55; χ^2 = 14, df = 1, p < 0.001) of MVs showed a positive relationship between DoS and LOs, with another 7% (n = 5) partially positive ("Mixed" values). No effect was found in 18% (n = 14) of MVs, and 3% (n = 2) showed a negative correlation between DoS and acquisition.

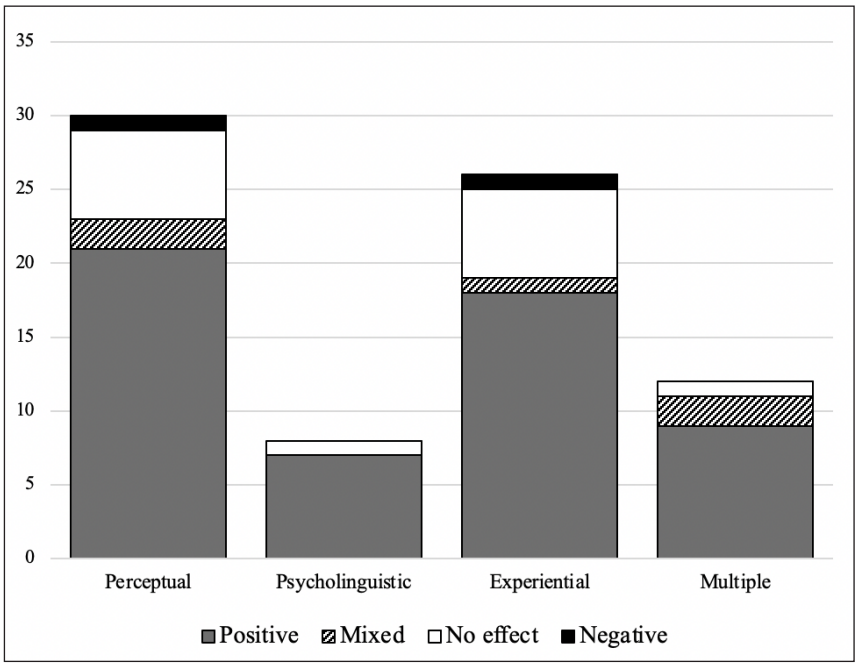

Figure 4 Salience effect by categorization.

Table 2 divides the categories into each MV's salience operationalizations and the resulting effects. As discussed in Section 3.3.1., many variables differed according to a combination of perceptual properties, which were treated as a single perceptual MV ("Combination" row). These represented 37% of perceptual variables.

Except for sonority and allomorphy, most operationalizations yielded more positive results than not. The two salience operationalizations of boundedness (perceptual) and semantic redundancy (psycholinguistic) only appeared in combination with other operationalizations rather than as isolated variables, so their individual effects were not measured within our sample.

OPERATIONALIZATION	POSITIVE	MIXED	NO EFFECT	NEGATIVE	TOTAL
Perceptual					
Combination	9	0	1	1	11
Substance	4	0	1	0	5
Syllabicity	2	0	0	0	2
Stress	1	1	0	0	2
Sonority	2	0	3	0	5
Position	3	1	1	0	5
Psycholinguistic					
Semantic value	5	0	0	0	5
Semantic transparency	1	0	0	0	1
Homophony	1	0	0	0	1
Allomorphy	0	0	1	0	1
Experiential					
L1 [dis]similarity	12	1	3	1	17
Exposure frequency	4	0	2	0	6
Contextual frequency	3	0	0	0	3

Table 2 Operationalizations of MVs by type, effect.

5.2. METHODOLOGICAL FACTORS

Most methodologies (*n* = 80 MVs, 82%) consisted of offline experimental tasks and gathered quantitative measures (e.g., grammaticality judgment tasks, sentence completion, forced-choice tasks, etc.). However, the wide variety of methods across the sample, let alone for a given MV, makes it difficult to draw conclusions about these methodologies as they apply to salience in SLA. Moreover, one issue with extant linguistic salience research is a lack of empirical affirmation of the effect of a given theorized salience manifestation on learners' online cognitive processes (i.e., whether it indeed manifests salience). Thus, we distinguished online methods within the sample for further consideration (see Table 3).

METHOD	POSITIVE	MIXED	NO EFFECT	NEGATIVE	TOTAL (% OF SAMPLE)
Online Cognitive Measures					
Eye-tracking	8	1	1	0	10 (10%)
Latencies (Reaction times)	4	0	0	0	4 (4%)
Neurophysiological	1	0	1	0	2 (2%)
Retrospective interviews	2	0	1	0	3 (3%)
Other					
Offline measures	53	7	17	3	80 (82%)

Table 3 Type of method used by effect found.

Note. Where multiple measures were used in a single study and/or multiple MVs were tested, each result therefrom is included as a separate value.

Of these, eye-tracking measures were used most often (10 MVs), identifying positive salience effects in all but two variables across experiments (generally, longer fixations on higher-salient items). One variable (Sagarra & Ellis, 2013, position MV) yielded mixed results, where a comparison of morphologically rich and morphologically poor L1 participants favored their expected preferred temporal cue (tense inflections for the former, temporal adverbs for the latter) regardless of position, but focused more on the second-position form in incongruent trials. The other variable (Cintrón-Valentín & Ellis, 2015, experiment 3, L1 [dis]similarity) found no effect of relative L1 dissimilarity in the learning of Latin verb tenses between Chinese-native (zero-morphology L1) participants and English-native (morphologically poor L1) participants from an earlier experiment. A neurophysiological methodology was used in one experiment (Shafer et al., 2021: electroencephalography [EEG]) which tested sonority and L1 [dis]similarity.

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Here, a positive effect (degrees of mismatch negativity in a discrimination task) was found in the latter variable only. Reaction times (RTs) were used on four variables, and all showed that greater salience led to faster RTs, indicating positive LOs. The only method used that specifically measured awareness (Leow, 2015) was retrospective interviews. Three studies employed this method, two of which (Azaz, 2017; Simoens et al., 2017) found a positive salience effect, while the third (Zalbidea, 2021) found no effect.

5.3. AVs

Figure 5 shows the AVs considered across the experiments and their effects. For clarity, the variables have been grouped as related to the learner, L2 input, or learning context.

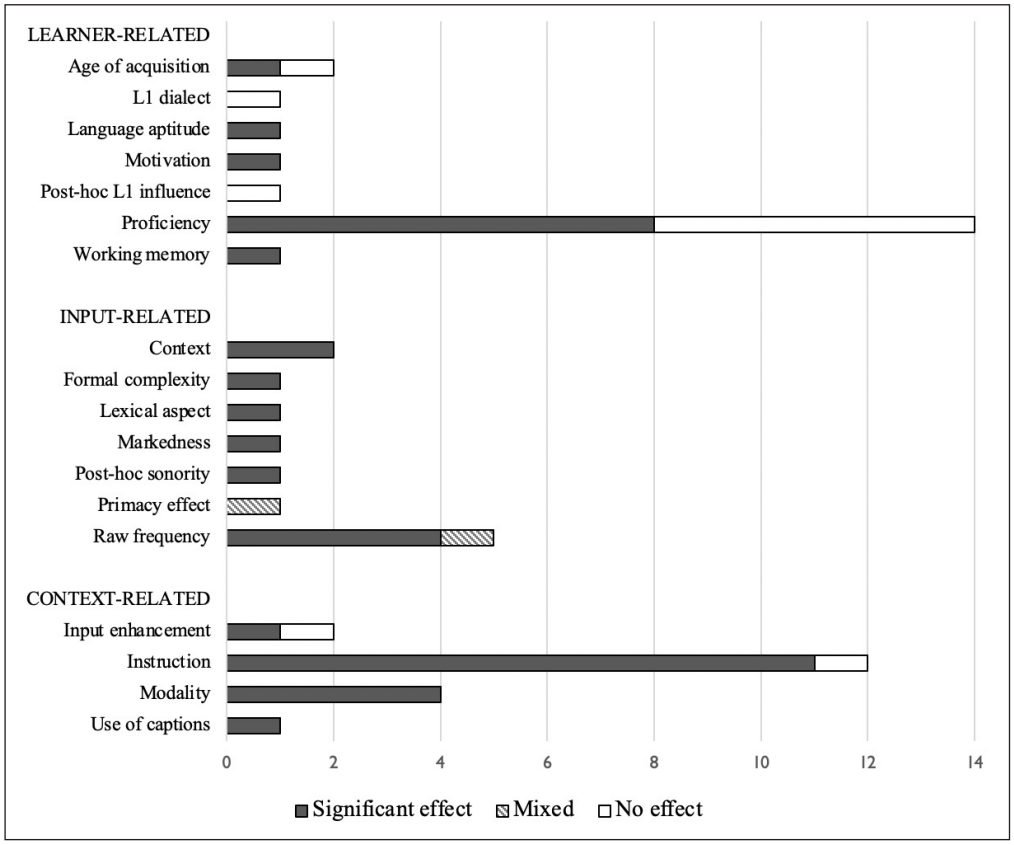

Figure 5 Additional variables considered across experiments.

Note. "Significant effect/ Mixed/No effect" labels indicate whether the AV was significant within the results (not necessarily in relation to any salience effect).

Most AVs were considered in relatively few experiments, so generalizing about their influence on salience is difficult. We therefore only further analyzed the two most prevalent variables across the experiments: proficiency and instruction. Eight experiments found a proficiency effect (not necessarily salience-related) while six did not. Table 4 illustrates the relationship between findings of proficiency effects and salience effects for each MV (n = 19) with which proficiency level was considered.

PROFICIENCY(P)/SALIENCE(S) EFFECT	NUMBER OF MVS
P Yes/S Yes	10
P Yes/S No	1
P No/S Yes	6
P No/S No	2

Table 4 Relationships between proficiency and salience effects.

Where both a salience- and proficiency-related effect were found, their relationship varied. Half (5 out of 10) showed greater sensitivity to salience differences among lower-proficiency learners (i.e., they performed better on higher- than lower-salience forms). One study (Sagarra et al., 2020), however, found salience effects only in higher-proficiency learners, while lower-proficiency learners showed no salience effect. For the remaining variables showing a positive effect for both salience and proficiency, performance generally increased with proficiency

but independently of any salience effect. Six variables showed a salience effect regardless of proficiency level, while two saw no effect of salience nor proficiency. One study found proficiency effects but no salience effect (Romano, 2015, L1 [dis]similarity MV).

Instruction of target features within the experiment was the second most prevalent AV. Where present, instruction yielded an effect in all but one experiment (Zhang, 2018). Most studies ($n = 8$) operationalized this variable as FFI of one form or another, finding either better performance on the form treated with FFI, regardless of DoS, and/or smaller differences in performance on target forms of varying DoS. Besides FFI, one study (Simoens et al., 2017) compared performance in implicit versus explicit testing conditions, wherein the explicit group performed better generally, but particularly on the high-salient form. Another investigation (Nassif, 2019) used input- or output-based task conditions, and while salience effect results were mixed, the output group performed better than the input group on the target forms regardless of salience differences.

6. DISCUSSION

We conducted a systematic review on the role of salience in L2 acquisition according to extant empirical research on the subject. We specifically focused on the operationalizations of salience, their effects, and how methodological differences, such as measures used and AVs considered, impacted these effects.

6.1. OPERATIONALIZATIONS

The first overarching question posed by Gass et al. (2017b, p. 1) was What makes an L2 feature salient? Our first research question concerning how salience has been operationalized in empirical research revealed the aspects of L2 input researchers considered to manifest linguistic salience. Given the many theorized manifestations of salience in the literature, we organized operationalizations into three categories. Although many researchers define salience broadly, its most common definition only encompasses our perceptual category. Unsurprisingly, therefore, perceptual properties were the most prevalent category in our sample. These operationalizations included substance, syllabicity, stress, sonority, and position (Figure 3, Table 2). However, perceptual MVs often combined multiple individual manifestations (11 MVs, 37%), while isolated individual manifestations were considered in comparatively few studies (most prevalently substance and sonority, $n = 5$ variables with each operationalization). One theorized perceptual manifestation, boundedness, was not tested in isolation, but appeared in composite MVs in several studies. Empirical evidence to support claims that a hypothesized salience manifestation impacts cognitive processes such as attention, awareness, and acquisition as expected remains limited (e.g., Graus & Coppen, 2015; DeKeyser, 2015). We therefore cannot answer the question of whether these individual properties are indeed salient or if the effects found are due to a concurrent salience manifestation or other external factors, necessitating future research in which these manifestations are isolated such that their individual effect can be affirmed.

Experiential operationalizations were the second-most represented within our sample, possibly due to their relationship with two seemingly unrelated topics of interest within SLA research: cross-linguistic influence (L1 experience) and frequency (L2 experience). Seventeen experiments compared L1 [dis]similarity of L2 features, the most of any individual MV in our sample. If more researchers considered these topics in relation to salience, the sample would have likely leaned overwhelmingly toward this category, but to date relatively few relate this phenomenon to salience, perhaps because it falls under a wider definition of salience than is most commonly accepted (DeKeyser et al., 2017). Nevertheless, its prevalence within our sample suggests a trend toward acceptance of L1 [dis]similarity as related to salience.

Frequency variables were also prevalent, most commonly exposure frequency to novel forms. Another manifestation was contextual frequency (how often a form appears within a particular context) which was operationalized in two ways: Differences in collocations of synonymous vocabulary words (Liu & Zhong, 2016) and surprisal of encountering a learned artificial L2 form in a new social context after participants were trained to expect a form in a different social context (Lai et al., 2020). The relationship between frequency and DoS was opposite in each of these studies, indicative of the complicated nature of frequency as a salience manifestation (e.g., Gass et al., 2017b). In Liu and Zhong (2016)—as is typical within semantics research (e.g.,

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Boswijk & Coler, 2020; Giora, 2003)—higher-frequency collocations were hypothesized as more salient, while in Lai et al. (2020), the lower-frequency form in the given context was expected to yield greater salience due to surprisal (cf. Ellis, 2017).

The least-represented category was psycholinguistic salience. Here again, psycholinguistic manifestations were often conflated with manifestations from other categories. Only one study (Dekeyser et al., 2017) isolated allomorphy and homonymy to measure their individual effects, whereas Romano (2015), for example, joined these with Goldschneider and DeKeyser's (2001) other factors, yielding an overall salience value which was compared between features. All other isolated examples of psycholinguistic MVs pertained to semantics, wherein the L2 input feature of interest included, non-exhaustively, ambiguous idioms (Cieślicka & Heredia, 2011), morphologically complex word processing (Koda, 2000), and basic versus sub/superordinate-level vocabulary recall (Xia & Wolf, 2010). Like boundedness in the perceptual category, semantic redundancy was not tested in isolation in our sample, but only in combination with perceptual properties, usually comparing temporal adverbs and tense inflections (e.g., Cintrón-Valentín & Ellis, 2015, 2016; Sagarra & Ellis, 2013).

In sum, while empirical research has operationalized salience in many ways, most individual manifestations require additional scrutiny to distinguish their effects on L2 acquisition from other salience properties. An apparent through-line among all categories is the difficulty of isolating any one salience manifestation, particularly in natural languages. Given the wide range of properties examined in our sample of studies—and even more proposed in theoretical research—it is challenging to identify any comparable L2 forms that do not differ in at least two, if not more, of these properties. Yet without this, we are unable to establish the effect of a specific salience manifestation on L2 acquisition. Future research will require meticulous valuing of individual salience properties and/or creative implementation of (semi-)artificial language to address this issue.

6.2. EFFECTS ON ACQUISITION

The second general question posed by Gass et al. (2017b, p. 1) was How does salience impact the acquisition process? Our research questions addressed this in several ways. First, having distinguished the MVs represented in empirical SLA research, we then investigated their effects on L2 acquisition to see if they had any impact on LOs. Gass et al.'s (2017a) overall premise was that greater salience yields greater learning, but some contributions therein came to opposite conclusions. For example, O'Grady et al. (2017) concluded that "[salience] has little impact, if any" (p. 83), while Lardiere (2017) argued that "detectability of grammatical feature contrasts is not limited to, and is likely only peripherally related to, the notion of perceptual salience" (p. 57). Our own results supported the broader view of Gass et al. (2017a). Most MVs yielded a positive effect of salience on LOs (Figure 4), with 79% of variables across studies yielding fully or partially positive results. All salience categories and nearly all individual MVs likewise yielded more positive results than not. Our results therefore suggest that salience of a form, in its myriad manifestations, impacts its acquisition.

Where individual MVs failed to yield positive acquisition effects, it may be due to low overall salience or minimal differences in DoS between target forms. For example, sonority was one of only two operationalizations that yielded fewer positive results than not. Sonority was often operationalized as vowel duration, which differs minimally between forms, and these experiments generally found no salience effect (Lengeris, 2009; Shafer et al., 2021). By comparison, consider variables operationalized as more than one salience property (the "multiple" category and "combination" perceptual manifestation). For example, Behney et al. (2017) used eye-tracking to compare attention levels to present- versus past-tense forms in Italian, the latter being considered more salient than the former according to substance (length), syllabicity (syllable number), and boundedness (auxiliary verb), culminating in large overall differences in the compared features' DoS. In the multiple and combination groups together (n = 23), only three (13%) did not yield at least partially positive results. Generally, overall salience, or DoS differences, between forms in these categories might be compounded by the numerous properties by which they differ, suggesting that the greater the salience of a form, or the greater the difference in salience between forms, the more likely it is to affect acquisition.

Some studies have found effects in relatively small DoS differences, however. For example, Teixeira (2015) found significant sonority effects when comparing regular Spanish subjunctive verbs.

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Although changing from present indicative to subjunctive in regular Spanish verbs only involves a single vowel shift, Teixeira posited that shifting from /e/ to /a/ yielded increased sonority, whereas the reverse yielded a decrease, making *-er/-ir* subjunctive verbs more salient than *-ar* verbs, and indeed, results showed better performance in *-er/-ir* verbs relative to *-ar*. Similarly, Simoens et al. (2017) found greater implicit learning of a three-letter than one-letter artificial morpheme. Thus, it is not impossible to find salience effects even in relatively low-level manifestations, but based on our results, the overall DoS seems likely to impact the extent of the effect.

6.3. METHODOLOGIES

Our third research question considered what methods have been used in empirical research on salience in SLA, and what—if anything—they reveal about the cognitive impact of tested MVs on the acquisition process. To this end, Section 5.3. distinguished a subset of methods (eye-tracking, neurophysiological methods, RTs, and interview protocols) that measured specific online cognitive processes that were key to understanding the role of salience in SLA (especially attention and awareness). A positive salience effect was found in nearly all instances in which one of these measures was employed, reaffirming the strong relationship between cognitive phenomena such as attention and awareness and salience, and their collective influence on L2 learning.

It is, therefore, surprising that these methods were relatively seldom used in our sample, except perhaps eye-tracking (employed for 13% of total MVs), whose use in SLA research has grown in popularity (Godfroid, 2020). Use of RT data, meanwhile, is a well-established method in SLA research. While its link to attention might not be as direct as that of eye-tracking, RTs have long been used to measure degrees of cognitive load in L2 processing, which relates to attentional differences (Saltzman & Garner, 1948) and to internal salience effects (e.g., Giora, 2003; Ellis, 2006, 2022). The starkest absence within our sample is neurophysiological methods. Only one study (Shafer et al., 2021) used EEG to test processing differences in vowel duration and L1 [dis]similarity. Online neurophysiological methods such as EEG, functional magnetic resonance imaging (fMRI), magnetoencephalography (MEG), and others are apt to measure online cognitive processes, which can include degrees of both attention and awareness that might occur subconsciously (e.g., Beck et al., 2001). Empirical investigation into the role of salience in L2 acquisition might therefore benefit greatly from incorporation of neurophysiological methodologies in future research.

Interview protocols are useful for measuring awareness (Leow, 2015). The small number of studies including such methods therefore suggests that awareness of target features has been largely ignored within salience research in SLA. Given its close link to attention (Gass et al., 2003) and the pervasive ambiguity of the role of awareness in SLA generally (e.g., Schmidt, 2010), this element also merits additional scrutiny within salience research.

6.4. AVs

It is important to note that any effect of salience does not exist in a vacuum and will likely be influenced by any number of external factors. Thus, our fourth research question considered how the relationship between salience and other variables was treated across our sample. However, although numerous AVs were considered, most appeared in very few studies. We therefore focused only on the two most prevalent variables: L2 proficiency and instruction.

Comparing salience effects across proficiency levels can indicate when a given salience effect is most relevant. Proficiency appeared as an AV in 14 experiments alongside 19 MVs. Comparing the relationship between these variables yielded various results (see Table 4). The effects of several MVs diminished with increased proficiency, affirming that salience effects are strongest in early learning stages. However, many studies saw proficiency effects independently of those of salience or no proficiency effects at all. Sagarra et al. (2020) found salience effects only among higher-proficiency learners, positing that early learners lacked access to the information that led to the salience effects observed among more advanced learners (e.g., animacy of object nouns, information that is more accessible as proficiency increases). Carroll (2006, 2012) argued against the Noticing Hypothesis and the role of salience in SLA by positing that salience is an outcome rather than a cause of learning. This is because the Noticing Hypothesis assumes enough knowledge of the L2 to be able to segment input into individual words or otherwise meaningful chunks for DoS differences to be relevant to the learner.

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The findings from Sagarra et al. (2020) lend support to this, given that a salience effect was only seen among higher-proficiency learners. However, this was a relatively uncommon finding compared to those that showed a diminishing effect of salience as proficiency increased. These apparently conflicting results suggest that the relationship between salience and proficiency likely varies by manifestation and/or other contextual differences. Further research is needed to better understand the nuances of this relationship and the level of granulation at which salience has the greatest effect on learning.

In contrast, instruction type showed positive results overall. FFI generally improved performance on instructed forms and often moderated salience effects between target forms. The only exception was an experiment with minimal instruction differentiation (Zhang, 2018). This finding has two implications. First, our results suggest that the negative impact of low salience on form acquisition can be mitigated through FFI. The moderating effects of FFI observed in our sample indicate that emphasizing low-salience forms in L2 learning contexts may help improve their acquisition (see also Goldschneider & DeKeyser, 2001). Second, parallel to the compounding effects of degrees of salience discussed in Section 6.2., the results regarding instruction suggest that greater overall attention to a form leads to better LOs, reaffirming the facilitative role of attention on L2 acquisition. Indeed, FFI falls within Gass et al.'s (2017b) definition of constructed salience, which they believe is of primary importance to L2 acquisition. Thus, although we chose not to investigate FFI within the lens of salience, the results of FFI as an AV might further support the importance of salience when the concept is framed differently (see also Doughty & Williams, 1998).

7. CONCLUSION

In the concluding chapter of the Gass et al. (2017a) volume, Spinner et al. (2017) stated that "one of the fundamental questions still remains: is salience a relevant factor in second language acquisition?" and further assert that "the time has come to precisely investigate the contributions salience makes in the acquisition of grammar, lexis, and other aspects of language" (p. 296). Through this systematic review, we aimed to see how this enduring fundamental question has been addressed empirically and to what extent researchers have answered their call for rigorous examination of salience and its role in L2 acquisition. We found that numerous salience manifestations have been operationalized in empirical research, although most still merit additional consideration, particularly where a salience manifestation can be isolated to measure its individual effects and establish its relative weight in determining composite salience of L2 forms. Overall, our results support the assertion that greater degrees of intrinsic linguistic salience correlate with better learning outcomes. While many methods to measure learning outcomes have been employed in salience-related studies, future research would benefit from increased use of methods for measuring online cognitive processes, particularly eye-tracking and methods for measuring awareness. Similarly, while numerous additional variables have been considered alongside salience, most have yet to be examined to a sufficient degree to draw cross-study conclusions about their relationship. In sum, L2 empirical research to date on the role of salience provides promising support to theories purporting salience as an important factor, but the field is still ripe for further investigation in order to truly encompass the multifaceted nature of salience and its as yet nebulous role in L2 acquisition.

Like any research endeavor, this systematic review is not without limitations. Most notably, while a meta-analysis could offer statistical insight into the descriptive results presented here, the wide variation across the studies in our sample regarding variables, subfield of interest, target languages, and methodologies rendered a meta-analysis unfeasible. The strong tendencies in our results support a salience effect on learning outcomes, but the overarching picture remains descriptive until the field is ready for a meta-analysis. Additionally, our search queries might not have captured all relevant studies. We focused on linguistic salience, a relatively new concept, so it is possible that properties we identified as salience manifestations have not been interpreted as salience elsewhere. Related terms from our sample used for certain salience manifestations included L1 blocking (L1 [dis]similarity), automatic selective perception (phonological L1 [dis] similarity), overshadowing (semantic redundancy), and sentence location principle (position). Future research focusing on a specific salience category or subset thereof might benefit from the inclusion of such terms in queries in order to encompass a wider range of studies on the subject. This is also true of frequency, which we only considered a salience manifestation under certain

conditions. A systematic review focusing on frequency as salience would be better able to consider raw frequency and other possible operationalizations. Despite these limitations, the positive results of this review regarding the effect of salience on L2 acquisition, as well as the remaining gaps in existing research that have been identified, should encourage continued research on the subject.

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COMPETING INTERESTS

The authors have no competing interests to declare.

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