POSITIVE FEEDBACK LOOPS IN SECOND LANGUAGE LEARNING

by

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List of Abbreviations

AI	Artificial Intelligence
BZ	Belousov-Zhabotinski
CAS	Complex Adaptive System
EFL	English as a Foreign Language
ESL	English as a Second Language
HSRRC	Human Subjects Research Review Committee
IL	Interlanguage
L1	First language
L2	Second language
Min.	Minute
N	Number
Obs.	Observed
PSU	Portland State University
S	Student
SLA	Second Language Acquisition
T	Teacher
VHS	Video Home System
+ Feedback	Positive Feedback

ABSTRACT

An abstract of the thesis of David Reigel for the Master of Arts in Teaching English to Speakers of Other Languages presented February 10, 2005.

Title: Positive Feedback Loops in Second Language Learning

What are the effects of positive feedback on student learning in the English language classroom? This study applies ideas from complexity theory to find a correlation between oral feedback and student language proficiency. The researcher collected data from digital recordings of adult students (N = 41) who attended 3 consecutive terms at the Portland State University Lab School. During the focused observation, the researcher recorded tokens of praise, affirmation, laughter, and nodding given by teachers and students in response to target student Interlanguage. Students provide far more affirmation than praise tokens to their peers, while teachers issue nearly equal frequencies of affirmation and praise tokens to students.

Statistical tests support the hypothesis that the rate of positive feedback received has an impact on English as a Second Language student course level promotion. A multiple linear regression analysis controls for the effects of confounding student variables such as initial course level, gender, and first language. A logistic regression analysis shows that rate of oral positive feedback significantly predicts English as a Second Language course level promotion.

Chapter One: Study Background

Introduction

How do learners acquire a second language? After 40 years, researchers in the field of Second Language Acquisition (SLA) have provided many answers. Numerous variables thought to affect acquisition have been identified, from cognitive and affective factors such as motivation, brain lateralization, aptitude, and attitude, to external influences such as access to other speakers of the target language, output opportunities, and comprehensible input, whether naturalistic or by effective instruction. With these variables affecting individuals in myriad ways, it is not likely that looking at the SLA process at the level of a given discrete variable will yield significant insight. One may argue the relative merits of each variable in isolation, but this approach is losing ground to a recent systems-level development, chaos and complexity theory. These theories offer new tools to look at dynamical systems without resorting to Newtonian reductionism. Several language theorists, most notably D. Larsen-Freeman (1997), in addition to Tudor, (2001), Ennis (1992), Steels (2000), and Shucart (2001), argue the worth of attempting to apply the chaos/complexity approaches of hard science to language learning. The researcher illuminates the vision of language and learning as a dynamic system, and identifies a specific application of one aspect of complexity theory to SLA, the essential element of positive feedback. To date, positive feedback is rarely mentioned in the SLA literature. Thus, a successful application thereof could lead to a development in the field.

Statement of Purpose

The ultimate goal of this study is to explore the usefulness of a dynamic systems model of SLA, especially the role of a positive feedback mechanism in English as a Second Language (ESL) learning. A secondary goal is to determine whether the presence of such a mechanism has a positive impact on second language learning. Although many studies have been done on error correction, these are essentially discussing negative feedback from the teacher. The interest in this study is on oral positive feedback directed toward the language learner, whether issued from the teacher or another student. As will be discussed, positive feedback has been noted to be a catalyst in complex systems development. Data from the Portland State University (PSU) Laboratory School will be examined to observe the effects of linguistic feedback. Several years of adult ESL courses have been recorded, and half of the data has been transcribed and/or coded by activity type. It will be possible for the researcher to identify tokens of positive feedback. The PSU Lab School data is ideal for such a study because English language learners may be observed using their second language in a relatively nonelicited forum. In addition to the usual teacher language found in a study of spoken discourse, the PSU Lab School database has many hours of student-student dyads. It is possible to observe instances of praise, affirmation, laughter, and nonverbal cues of a supportive nature in these student-based data, at a level of scrutiny not previously known.

What Are Complex Adaptive Systems

What are complex systems? A complex dynamical system is a group of interacting agents generating a behavior that is different from the sum of the parts. According to Steels (1997), global coherence is reached in spite of local nonlinear interaction of the agents. An example of a dynamic system is a heated Benard fluid. Heated particles self-organize, forming an emergent structure similar to that of an organism. The system passes through several different stages before achieving its complex form. Within the field of complex dynamical systems is the subclass Complex Adaptive Systems (CASs), dynamic systems whose laws are not constant. This model, a hallmark of complexity science, has been applied to many common phenomena in different fields, including economies, genetic evolution, ecological systems, and social systems. What if such a model could be applied to an English language learner's Interlanguage (IL)? This thesis will attempt to establish a grounded research base in this area.

Properties of Complex Adaptive Systems

Before considering connections between Interlanguage and a Complex Adaptive System (CAS), it is important to review the general properties of Complex Adaptive Systems. In describing these properties as applied to the human brain at the first Santa Fe Institute economics workshop, John Holland (as cited in Waldrop, 1992, p. 145) identifies several key characteristics common in CASs:

1) CASs are made up of a network of agents. For example, in a brain, the agents are nerve cells. The network is not centrally controlled; there is no master neuron in the brain.
2) A CAS has different levels of organization, with agents interacting at each. In the brain, one group of neurons will form the speech centers, another will form the motor cortex, and another the visual cortex.
3) These levels of organization within the system change as the system gains experience. The brain strengthens or weakens neuron links depending on what has been learned.
4) CASs anticipate the future. The brain has implicit predictions encoded as a consequence of what has been learned: In situation ABC, action XYZ is likely to pay off.
5) CASs typically have many niches that are filled by agents.

In 3), the issue of learning is central. It is this aspect of CASs that has the most to do with SLA. Similarities are to be found in the specific SLA area of Interlanguage (IL), the transition language between a student's first language (L1) and second language (L2).

Properties of Interlanguage

Interlanguage (IL) is the language system that a second language learner creates in response to linguistic input (Larsen-Freeman & Long, 1991). IL may be thought of as a continuum traveled between the L1 and L2. At any position along this continuum the learners' language is systematic, and differences in development may be explained by differences in their learning experiences. Like CASs, students' ILs vary systematically. In reviewing research to date of publication, Larsen-Freeman and Long identify several key elements of variance in ILs:

1) In developmental terms, ILs typically change quickly. The authors hypothesize that second language learners will change their IL to fit target language input, since chances are they won't be exposed to similar ILs.
2) ILs are at least partly rule-governed, even in their most variable areas. As a consequence, ILs may respond to systematic change, for example, to instruction.
3) In a student's IL, there are complex variables at work, such as task demands of communicative tasks and of creating discourse in response to input.

Ellis' (1985) model of IL is even more chaotic, emphasizing free variability as the driving force for IL change. IL users often shift "erratically among a wide range of sounds and lexical items during the learning process" (Larsen-Freeman & Long, 1991, p. 86). Given similarities between CASs and ILs, in the 1990s some members of the SLA research community recommended exploring the application of findings in

complexity science to ILs.

One of the earliest such suggestions is made in Bowers' 1990 paper, "Mountains Are Not Cones: What Can We Learn From Chaos?" Bowers (1990) cites Gleick as claiming that in "nonlinearity and feedback lay all the necessary tools for encoding and then unfolding structures as rich as the human brain" (p. 307). At this stage in the language learning literature, these musings are pure speculation, with little notion of actual research projects.

In "Chaos/Complexity Science and SLA," Larsen-Freeman (1997) asserts that findings from complexity science may be used to reevaluate our basic assumptions about learning mechanisms in SLA. This is possible due to several similarities between nonlinear systems and a learner's IL. Both are dynamic, complex, and nonlinear. A nonlinear system is one in which the effect is disproportionate to the cause. Both CASs and ILs are unpredictable, and sensitive to initial conditions: For example, Larsen-Freeman (1997) mentions Lorenz' 'butterfly effect' (p. 144) as an example of a phenomenon in weather systems that accentuates the interdependence of system variables. The butterfly effect is illustrated hypothetically by the tiny perturbation caused by a butterfly flapping its wings in Brazil eventually compounding itself with other variables to create a tornado in Texas. A parallel in SLA may include a learner's L1 educational attainment as an initial condition in pursuing an L2. CASs and ILs have a flexible nature in that they are feedback sensitive, adaptive, and self-organizing. This is at the heart of the learning process, "testing a model to reality and then modifying it to suit" (Larsen-Freeman, 1997, p. 144).

Studies of nonlinear systems—those in which effects are disproportionate to their causes—may provide insight into several "enduring conundrums" (Larsen-Freeman, 1997, p. 152) of SLA, foremost the question of "*mechanisms* [italics added] of acquisition" (p. 152). Larsen-Freeman invokes the Piaget-Chomsky debates of 1975 and the conflicting innatist versus constructivist paradigms as a matter to be resolved by research within the complexity paradigm. Larsen-Freeman's article is seminal in that it is frequently referenced in the related SLA literature, and is a major catalyst for this project.

In response to "Chaos/Complexity Science and Second Language Acquisition," Sower (1997) queries Larsen-Freeman as to the sources of inspiration for her proposed connection between chaos theory and SLA. Gleick (1987) is cited as a key source. Larsen-Freeman notes the obvious connections: SLA is dynamic, nonlinear, and a learner's IL is complex. Larsen-Freeman rejects SLA research that employs univariate analyses of affective variables, since complexity theory argues against reductionism, and recommends against simple pretest/posttest research designs. Therefore, the design of this thesis will be a focused observation of recorded classroom IL, without interference by experiment.

Chapter Two: Literature Review

Properties of Positive Feedback in Complexity Science Literature

The notion of positive feedback loops as discussed here originates from the intersection of economics and physics. Arthur (1989) and other economic theorists at Stanford University and the Santa Fe Institute create a model of an economy based on increasing, not diminishing returns. A lucid example Arthur provides is that of the establishment of video cassette recorder technology in the 1980s. Toward the beginning of video cassette recorder technology, Betamax and VHS had roughly equal market share, with some maintaining that Betamax was the superior technology. However, once VHS got a slight market edge over Betamax, more technologies—video cassette recorders for VHS, for example—sprouted in support of the VHS, and a positive feedback loop was created. The slight advantage of VHS exploded into complete market dominance, ultimately displacing Betamax as a competitor. Note that if Betamax actually were the superior technology, this is not a clear cut case of survival of the fittest.

Arthur (1989) maintains that information and high technologies are more susceptible to increasing returns economics than resource-based sectors such as agriculture and mining. That is because once high start-up research and development costs are met in development of a new technology, the product costs less to fine-tune, manufacture, and distribute as experience is gained. This correlates with a learning curve. Instead of a static, deterministic process, a given economy can be modeled as a

dynamic process containing self-reinforcing mechanisms. As was the case with Japanese auto makers gaining market share in the 1980s, the more people adopted these new technologies, the more the technology improved, resulting in more incentive for further adoption—a positive feedback loop. Arthur also mentions the ever-increasing use of the English language as an emerging standard subject to such mechanisms.

According to Waldrop (1992), Arthur is examining "third-order" (p. 138) nonlinearities, what engineers call positive feedback. At the initial academic presentation on September 8, 1987 at New Mexico's Santa Fe Institute, Arthur likens an economy to the spin glass problem. A spin glass has a rich mixture of positive and negative feedbacks that form a CAS. As a result, the state of the spin glass fluctuates between that of a solid or a liquid. The difference between positive and negative feedback can be illustrated by the example of spilling water on a polished tray. Gravity provides the negative feedback, and the attraction of the water molecules gives the positive feedback. Just as the water spill yields a different combination of droplets every time, so tiny "accidents of history" (Waldrop, 1992, p. 36) become magnified by positive feedbacks into major differences at the outcome.

Positive Feedback Loops in Complexity Science Literature

In this section, additional examples of positive feedback mechanisms are given. Readers without a scientific interest may wish to forward to the Education Literature section. Briggs (1992) reinforces the significance of the mechanism of feedback in nature. Feedback and iteration are dubbed "the heartbeat of chaos" (Briggs, 1992, p. 115), since in a dynamic system feedback among the parts can affect the whole. It is the interplay of positive and negative feedback that gives the complete system its complexity. Positive feedback pushes systems to expand; an example provided is of a television camera pointed at its own monitor. While the action of pointing the camera at its monitor is basic, the resulting images are kaleidoscopic, with the likeness of the camera trailing away into infinity.

Briggs (1992) additionally identifies positive feedback as an agent in evolution, and in climatology. Positive feedback loops nudge an environment toward change. For example, when feedback loops occur in primordial situation such as development of a slime mold structure, or in the Belousov-Zhabotinski (BZ) reaction, structure is created in a self-organizing fashion. Thus, Briggs (1992) posits that "feedback is perhaps the key element in transitions from chaos to order and from order to chaos" (p. 119), which is relevant as applied to a model of learning as a complex system in the human cognitive structure.

Prigogine and Nicolis (1989) detail mathematically many primordial processes containing emergent phenomenon. In the BZ chemical reaction, a feedback loop is involved in generating complexity in the fluid. If the rate of reaction (catalysis)

increases, a positive loop is its cause. A similar process occurs in a slime mold *Dictyostelium discoideum*, with a feedback loop a significant mechanism in growth of the mold, modeled by oscillatory synthesis. The positive feedback mechanism is capable of amplifying signals and inducing "oscillatory behavior" (Prigogine & Nicolis, 1989, p. 36). At the systems level, the authors discuss ant colony development. They characterize an ant colony as having remarkable adaptability and transitions to different modes of behavior triggered by environmental conditions, despite the ants' possession of minimal programming at the individual genetic level.

Gleick (1987) set the standard for the popular understanding of chaos theory. Though not a focal point of the theory, feedback is a powerful mechanism in several scientific areas: In ecology, the logistic equation that models population growth over time is an excellent example of a positive feedback loop, with each year's population output serving as the next year's input; in physics, nonlinear feedback regulates motion, making it more robust; in mathematics, a feedback loop is involved in the development of one of the most complex mathematical objects known, the Mandelbrot set; and in genetics, Ford suggests that "evolution is chaos with feedback" (as cited in Gleick, 1987, p. 314), demonstrating that randomness with direction can produce a surprising amount of complexity.

At the cognitive level, feedback is also omnipresent, an essential facilitator of thought. Holland (1998) describes properties of feedback loops in neural networks. Pulses from a given neuron travel to axons via a network of synapses and then feed back to restimulate the originating neuron. "Feedback can make loops of connections

reverberate" (Holland, 1998, p. 20) without further stimulation. Networks with these cycles can generate behaviors "that far surpass the limited pattern recognition capabilities of feedforward networks" (Holland, 1998, p. 96), an indicator of a CAS. Holland (1998) proposes that a neural network without feedback loops is "far less capable" (p. 101) than a system that includes loops.

The workings of the albedo feedback are described by Holland (1998) as an example of a complex process developing from minimal initial conditions. Ice at the earth's poles reflects a fraction of available sunlight that escapes into space, the albedo. The albedo phenomenon is detailed by Sturm, Perovich, and Serreze (2003). This research team attempts to determine if greenhouse gases or other processes are causing temperatures to change, in the Arctic in particular. The feedback systems at work in this locality make it a challenge for researchers to predict future temperature trends. The positive feedback processes amplify change, whereas negative feedbacks mitigate it. When ice melts in spring, more sunlight remains at earth's surface because there is less ice to reflect the light off into space. With less ice, there are higher temperatures, which cause more melting, which allows more light to stay at the surface level, and so on. Though not necessarily leading to the desired result of stable temperatures, positive feedback mechanisms act as a catalyst in changing the system—drawing a parallel with the goal of changing a second language learner's IL.

Theoretical Perspectives on Feedback in Education and SLA Literature

In "Reconceptualizing Learning as a Dynamical System," Ennis (1992) calls for a move away from reductionist analytical approaches in educational research. Traditionally, Ennis argues, educational researchers break components of the curriculum, the learner, and instruction into increasingly smaller parts, but in the new complexity paradigm, researchers may consider larger components of the educational system. As in dynamical systems theory, learner apprehension of new inputs is selective: Not all inputs are automatically processed and committed to memory. As a consequence, Ennis holds that learning is not predictable at certain points along the learning curve. One way to proceed is to identify critical points in a learner's path—referred to in the chaos literature as points of bifurcation—and then look at the outcomes following these decisions.

Continuing in the vein of speculation, Cunningham (2000) suggests that interesting possibilities await the application of the complexity theory to the study of education. Research in this direction would be appropriate, since many systems in education fit the criteria of nonlinear systems. Small variations in initial conditions—for example, a basic mathematics deficiency in fifth grade—can lead to large differences in outcomes, such as failure in high school algebra. This is exemplified by the reinforcement provided by positive feedback. An example of positive feedback given is that of a microphone pointed toward a speaker in a public address system. This feedback leads to noise, the system spiraling beyond control. The effect is disproportionate to its cause, an indicator of a CAS. The theme of learning and

feedback goes beyond the level of individual students (Black & Wiliam, 1998). However, the level of individual students is the easiest at which to start, since it is possible to track an individual's progress accurately.

Mallows (2002) examines Larsen-Freeman's 1997 article, which he holds to be "intuitively correct" (p. 3). He agrees that it can be difficult for language practitioners to determine "example will be . . . the pebble that sets off the landslide" (Mallows, 2002, p. 4), in the sense of knowing exactly which L2 input it will have a lasting effect on the IL. The SLA process is known to be complex, with a nonlinear learning curve for a single item; if depicted graphically, the process would be represented by the logistic s-shaped curve.

Dynamic patterns in the learner's complex IL system display feedback loops: The IL uses feedback to move on, develop, and evolve. Mallows (2002) proposes that feedback loops as described by Larsen-Freeman can be applied to second language learning. In cognition, the agents are individual minds; the learner receives feedback from teachers and/or experience; and the language improvement is called learning. The learner's IL is self-referencing, because it is not produced by the known rules of the L2—the IL reacts to and is changed by the feedback received. If a learner's IL fossilizes, then the system closes, settling into a steady state.

Shucart (2001) asserts that IL is a CAS, and reviews the key elements of these systems. According to Larsen-Freeman (as cited by Shucart, 2001, p. 3), CASs are

1) Dynamic;

2) Complex;

3) Nonlinear;

4) Chaotic (random, but with deep structural patterns);

5) Unpredictable;

6) Sensitive to initial conditions;

7) Open;

8) Self-organizing;

9) *Feedback sensitive* [italics added]; and

10) Adaptive.

Shucart views SLA as a kind of emergence, and recommends using complexity-based frameworks for modeling language acquisition. Among examples given of such possible frameworks are Wolfram's (1984) cellular automata classes; Kauffman's (1995) "chasing the red queen" model of genetic evolution; and Shucart's (2001) "Terraced Labyrinth" model of second language learning. Shucart's "Terraced Labyrinth" model alleviates the need to posit Chomsky's Language Acquisition Device, because language acquisition points align with bifurcations in a "tree" of information.

With discussion of trees and Chomsky, let us revisit some of the classic innatist arguments, which may work against the notion of an effective external

influence on a learner's IL. Chomsky (1957) alludes to loops as a potential language mechanism in his description of a Markov process. In a given sentence, the structure can be thought of as the state of the sentence. Normally, the flow of words runs in English from left to right, a unidirectional flow that constitutes a finite state. Though these fundamental Markovian structures can be enhanced by loop mechanisms, such an addition cannot still account for all the possible grammatical combinations. Thus, Chomsky concludes, English is not a finite state language.

In his renowned review of Skinner's *Verbal Behavior*, Chomsky (1959) moves toward a more aggressive assertion of his innatist theory of language development in his thorough rejection of Skinner's doctrine. Skinner posits the notion of behaviorism, which holds that although sentient beings such as animals and people may have certain thoughts or opinions about what they are doing, in fact what they do is determined by their observable actions. Skinner further suggests that what we do by committing various speech acts is influenced by reinforcement. Chomksy takes issue with Skinner's definition of reinforcement as too broad, and argues that reinforcement is not required for language learning to occur. The main counterevidence is given by the example of children's L1 acquisition, which is a fundamental process independent of "feedback" (Chomsky, 1959, p. 12) from the environment. Chomsky asserted in 1959 that there was neither empirical evidence nor known argument to support the claim of significance of feedback from the environment in language acquisition. However, his emphasis was on the structure of the target, not on an internal learning mechanism. Chomsky (1959) mentions studies done in the 1950s finding a positive result of

praise—"right," "good" (p. 23)—on language acquisition of selected forms.

Piatelli-Palmarini (1980) proposes that cybernetic feedback loops and information flows are the "cornerstone of cognition" (p. 3) in the context of the 1975 debate on language and learning between Chomsky and Piaget. Editor Piatelli-Palmarini (1980) uses the metaphors of the crystal, "invariance of structures," and the flame, "constancy of external forms in spite of relentless internal agitation" (p. 6), to characterize the conflicting innatist and constructivist positions taken by Chomsky and Piaget, respectively. This debate shifts attention from learning curves and onto "the *mechanisms* [italics added] of learning" (Piatelli-Palmarini, 1980, p. 308). Feedback is sporadically discussed in terms of its workings at the cognitive level: In neural networks, loops "make possible Piagetian reflectings and setting of correspondence between levels" (Piatelli-Palmarini, 1980, p. 188); Piaget suggests that genetic phenocopy contains a feedback mechanism; and Papert, in discussing the role of Artificial Intelligence (AI) in psychology, propounds that an artificial perceptron device contains a learning mechanism that uses feedback to alter its weighting coefficients. All of this implies that feedback is an agent at the unobservable cognitive level, the same area where SLA is believed to occur. By proximity the reader can hypothesize the potential import of feedback in the cognitive domain.

In *An Introduction to Second Language Acquisition Research*, Larsen-Freeman and Long (1991) raise several objections to Chomsky's Universal Grammar (UG): The notion of degenerate input for L1 learners has been proven false; the idea that L1 acquisition is mostly complete by age five is contestable; and the position that certain

syntactic principles are not learnable and therefore innate are being increasingly challenged. Larsen-Freeman and Long accordingly point toward research on the multi-functionality of corrective feedback devices in the manner of Chaudron (1988) as a potentially promising area in SLA.

Kohn (1993) addresses the question of how "rewards punish" (p. 52), citing dozens of studies in his effort to discredit Skinner's behaviorism. Within the discussion of praise at home, school, and work Kohn (1993) distinguishes between forms of "positive feedback" (p. 96): It can be straightforward information about how well someone has done at a task. Kohn (1993) terms this type of positive feedback "informational feedback" (p. 96); elsewhere in this review it may be characterized as "effort feedback." Alternatively, there are "verbal rewards that feel controlling and make one dependent on someone else's approval" (Kohn, 1993, p. 96). This type of feedback is arising when there is a discrepancy between the speaker's intent and the hearer's perception: The intent may be to offer useful feedback about the quality of someone's work, but the hearer may interpret the message as limiting autonomy.

Kohn's advice is for the speaker to provide informational feedback without giving praise. A problem here is the affect involved in the informational feedback; it will be evaluated as being either positive or negative, depending on the connotation. Kohn (1993) advises that the speaker "only praise what people do" (p. 108), make the praise as specific to the task on hand as possible, and to avoid phony praise. Feedback should be given by teachers to students, Kohn argues: It is an essential element of the educational process, because students need information to know if their performance

is up to par. However, praise does not need to be included in this: Brophy (1981) believes that "It is essential that students get feedback about their academic progress and classroom conduct . . . [but] . . . students do not actually need praise in order to master the curriculum, to acquire acceptable student role behaviors, or even develop healthy self-concepts" (as cited in Kohn, 1993, p. 107).

What type of teacher feedback do students prefer? Would students rather be praised or corrected, for example? Prabhu (1992) explores the notion of the language lesson as a classroom event. A conflict may arise if a method requires a teacher to be "maximally supportive" (Prabhu, 1992, p. 230) of the students, highlighting positive feedback, but learners view teacher praise as a form of surrender or opportunism. For example, a student population may believe "there is bravery in defying the teacher's wishes" (Prabhu, 1992, p. 230).

Language teaching research reflects a growing awareness of the complex dynamics in the language classroom (Tudor, 2001, p. 25). As previously discussed, study of this phenomenon has connections to findings in complexity science. Van Lier's ecological perspective on language learning is a model of the language classroom as a CAS. Tudor's reflection considers different interpersonal dynamics involved in creating this classroom, notably the intersections of perspectives of course planners, teachers, and students.

Vigil and Oller (1976) posit IL fossilization as a consequence of excess positive extrinsic feedback for erroneous forms used (as cited in Kuo, 2003). Affective feedback—including paralinguistic devices such as facial expressions—overrides

cognitive feedback such as affirmations that show whether a speaker's message has been understood. Vigil and Oller distinguish between positive affective feedback—praise, such as "I like it," or nonverbal cues—and reinforcement from cognitive feedback, or affirmation, such as "I understand it" (as cited in Kuo, 2003, p. 4). Vigil and Oller theorize that negative cognitive feedback is required to destabilize IL fossilization, making a claim that a finding in this thesis would negate. Kuo (2003) puts forth that a primary task for language teachers is to "discern the optimal tension between positive and negative feedback" (p. 10) striking a balance that offers enough encouragement to motivate the learner, but not so much that errors are overlooked.

Long (1990) emphasizes the importance of mechanisms in SLA. Long defines mechanisms as devices specifying how cognitive functions operate on input to move a grammar at a Time 1 to its new representation at a Time 2. A student's improvement in learning can be observed in the IL, the observable data. More importantly, Long emphasizes the role of feedback as a trigger in bringing about learner noticing (Schmidt, 1993). The learner gets feedback, whether positive or negative, and as a result pays attention to the linguistic feature to be acquired. An adequate theory of SLA, Long argues, must account for the mechanism that facilitates the change in the learner's IL.

Classroom Feedback Studies

Burnett (2002) surveys 747 Australian elementary school students to determine which types of classroom feedback they prefer. Burnett's conclusion from a Likert-scale questionnaire is that effort feedback and negative teacher feedback are related to the students' perceived relationships with their teachers, and generally satisfied students feel they receive more positive feedback (characterized as general praise, general ability feedback, and effort feedback) and less negative teacher feedback than generally dissatisfied students. In reviewing the education literature, Burnett lists several definitions of key terms: According to Thomas (1991) and Blote (1995), praise is positive reinforcement that contains positive affect and is a more intense response to student behavior than general feedback. Attributional feedback distinguishes between effort and ability: Effort feedback is given in assessment of perseverance on a task. Brophy (1981) suggests that teachers rarely praise students in class, using 6% of the total instructional time on average to do so (as cited in Burnett, 2002, p. 7). Merrett and Wheldall (1987) observe that "Even in a classroom, where a teacher praises once every five minutes, the rate of praise for the average student would be . . . once every two hours" (as cited in Burnett, 2002, p. 7). In general the frequency of both positive and negative feedback is low in the elementary L1 classroom.

In "Teacher Praise: What Students Want," Elwell and Tiberio (1994) administer a "Praise Attitude Questionnaire" to 620 secondary (grades 7—12) students in three suburban Rochester, New York-area schools. The researchers attempt to determine whether students generally value praise, since many teachers and

administrators may, but many students may or may not—especially in a whole-class setting. Following the Praise Attitude Questionnaire, the researchers conclude that most students perceive praise as an important element in their social and academic behaviors. Students on average prefer private instead of public praise, the more so with age (the higher the grade, the less the desire for public praise). Ward (1983) suggests that "praise delivered contingently by a teacher to an adolescent as simple interpersonal communication is reinforcing; in the presence of a peer group it can be punishing" (as cited in Elwell & Tiberio, 1994, p. 1).

While not explicitly addressing feedback, Nystrand, Gamoran, Kachur, and Prendergast (1997) describe the conditions involved for "opening dialogue" (p. 39) in the standard K—12 English classroom. An indication a message has been received in dialogue is *uptake*, defined as occurring when the hearer asks the speaker about something previously said. The authors stipulate that meanings emerge through conversation, with the speaker and hearer arriving at a shared understanding, much in the sense of Vygotsky's *negotiation of meaning*. Without this negotiation, learning essentially stalls, the authors argue. After observing hundreds of 8th- and 9th-grade English classes in 84 Illinois schools over 2 years, the authors conclude that English classroom discourse is "overwhelmingly monologic" (1997, p. 33) and that the time spent on class discussion has a positive effect on learning. This finding is relevant to this project because uptake is an indicator that feedback has been given or perceived, and it occurs only if there is a sharing of ideas by interlocutors.

Ferguson and Houghton (1992) conduct an empirical study ($N = 24$)

examining the effectiveness of contingent teacher praise as applied in Canter's Assertive Discipline Program. The researchers tally frequencies of praise in three classrooms in West Australian elementary schools before the intervention. In the baseline, no teacher is found to give praise in excess of 10 times per 15 minutes, a normalized rate of .6667 praise tokens per minute. During the intervention—which involves focusing on positive student behavior to verbally reward rather than negative behavior to reprimand—the ratio of positive to negative feedback increases along with the frequency of praise and increased amount of on-task time. With the teachers' attention redirected to positive student behavior, teachers find more opportunities to dispense praise. More importantly, Ferguson and Houghton (1992) surmise that "conversely, it may be that increased levels of on-task behaviour by children positively reinforced the teachers and contributed to increased levels of praise. This may be an area deserving further investigation" (p. 5). The present study includes a discussion of causality following the data analysis.

El-Tatawy (2002) provides a comprehensive survey of negative feedback in SLA. First, El-Tatawy reviews several definitions of corrective negative feedback, as it occurs in oral production. Chaudron (1988) identifies corrective feedback as "any teacher behavior that minimally attempts to inform the learner of the fact of error" (as cited in El-Tatawy, 2002, p. 1). Lightbown and Spada (1999) similarly define corrective feedback as "any indication to learners that their use of target language is incorrect" (as cited in El-Tatawy, 2002, p. 1) and this feedback can be either explicit or implicit. Schacter (1991) describes implicit feedback as confirmation checks,

repetitions, recasts, clarification requests, silence, or facial expressions. Long (1996), Gass (1991), and Chaudron (1988) all agree that corrective feedback plays a pivotal role in SLA. Gass (1991) suggests that feedback may act as an attention-getting device that triggers SLA, in accordance with Schmidt's (1993) noticing hypothesis.

El-Tatawy (2002) continues the summary of research related to the impact of corrective feedback. Tomasello and Herron (1989) propose that SLA occurs as a result of learners following the Garden Path technique, in which they generate hypotheses about the L2 and receive immediate feedback as to the accuracy of their hypotheses. What kinds of feedback could these learners receive? Lyster and Ranta (1997) identify seven types of teacher feedback in the language classroom: "explicit correction, recasts, clarification requests, metalinguistic feedback, elicitation, repetition, and multiple forms of feedback" (as cited in El-Tatawy, 2002, p. 8). The researchers conclude with a finding that recasts are the most common type of teacher feedback, and also the most likely to lead to additional student response, also known as uptake (69% of recasts). In a follow-up to Lyster and Ranta's study, Mackey, Gass, and McDonough (2000) determine that many learners who did not give uptake following the recasts do not perceive the recasts as such; this leads to the hypothesis that corrective feedback is most effective when perceived. In turn Han (2001) studies fine-tuned feedback, and finds that when tailored to the student's ability to perceive feedback, corrective feedback is successful in facilitating SLA. El-Tatawy recommends longitudinal studies to investigate relationships among different types of feedback, modified output, and L2 development, and to increase our comprehension of

the nature of fine-tuning corrective feedback.

As a potential component of positive feedback, laughter has been rarely studied empirically in the second language learning environment. However, use of humor is a frequently recommended second language classroom teaching strategy. Broner and Tarone (2001) analyze 13 hours of naturally occurring 5th-grade student IL in a Spanish L2 immersion classroom. The study focuses on three students and their interactions, recorded by lapel microphones and transferred to audiotapes. From the recordings, standard orthographic transcriptions are developed. The researchers attempt to locate instances of ludic language play, because, in accordance with Larsen-Freeman's (1997) conceptualization of IL as a CAS, laughter may work to destabilize the system. Unfortunately, the ludic play is not evaluated in a quantitative manner that may have led to a finding.

In an action research case study, Magilow (1999) articulates a link between error correction and classroom affect in his Princeton German L2 classes he taught while a graduate teaching assistant. Magilow identifies the complicated balancing act of the language teacher; that is, providing an inclusive, comfortable classroom environment while at the same time correcting overt errors in student IL. Magilow proposes that once positive affect is enacted—by use of humor, anecdotes, and a personable tone—it is possible for the teacher to correct student errors without damaging student self-perception. Magilow finds that many students in his class prefer more negative teacher feedback than had been given, and also for the teacher to allow more student-to-student talk, time often monopolized by the teacher, as discussed by

Nystrand et al. (1997). The case study conclusion is that the question of feedback may be inseparable from that of rapport. Once a teacher-student rapport is established, explicit error correction may be effective.

Rossiter (2003) tests the effects of "affective strategy training" (p. 1) that is given to adult Canadian ESL students. An experimental group of intermediate-level students ($N = 15$) received 12 hours of training in relaxation techniques, deep breathing exercises, laughter, making positive statements, and discussing feelings with peers. After experimental and control groups receive 15 weeks of ESL instruction, Rossiter makes no finding of differential success between the groups resulting from the affective training. There is "no significant between-group benefit" (Rossiter, 2003, p. 18) for L2 performance, as determined by dyadic speaking tasks and student surveys of self-efficacy. Rossiter recommends that ESL practitioners give students relevant informational feedback in order to enhance SLA.

Burrell (2000) conducts a modified replication of a survey conducted of Japanese English as a Foreign Language (EFL) university students. The study finds that adult Latino ESL students have a positive affect toward teacher error correction. The Latino students ($N = 172$) prefer that the ESL teacher repeat their questions, or ask the student to repeat their answers if incorrect. The least preferred error correction method is implicit correction, defined as either nonverbal cues or ignoring the error. In Burrell's literature review, Kubota (1994) finds in a study modeled on one conducted by Carroll and Swain (1993) that an experimental group receiving explicit metalinguistic feedback performs better on language learning tasks than a control

group receiving no feedback on their IL. Both explicit and implicit feedback are found to facilitate SLA. As a result, Pica (1994) posits that "what has been advanced about the role of correction in the learning process mitigates considerably the claim of Krashen that comprehensible input is all that is needed for successful language acquisition" (as cited in Burrell, 2000, p. 26).

Imai's (1989) thesis goal is to determine whether correction or praise is more likely to improve oral L2 proficiency. Imai hypothesizes that Japanese EFL university students ($N = 40$) will have their grammar and pronunciation improve as a result of error correction, but fluency and comprehensibility would improve by praise. Imai's conclusion is that neither praise nor correction has significantly different effects on pronunciation; correction may have had a positive effect on oral comprehensibility.

Imai's (1989) literature review discusses the role of feedback in SLA. Seliger (1983) defines feedback as either teacher correction on isolated forms, adjusted "foreigner talk" (as cited in Imai, 1989, p. 17), or conversational responses. Vigil and Oller (1976) propose that positive feedback may take the form of praise markers such as "OK," "fine," "good," and "excellent" (as cited in Imai, 1989, p. 18), as well as a positive personal response. Moskowitz (1976) describes teacher techniques related to feedback. Moskowitz characterizes effective feedback as immediate and direct. It is best given in a warm, accepting classroom climate. Effective praise for student behavior is frequent, varied, and often nonverbal. Long (1983) recommends testing the effects of various kinds of feedback on language accuracy.

Alternative Environment Feedback Studies

Steels (2000) describes the 1990s trend of language researchers beginning to apply a complexity science approach. If a community of language users can be viewed as a CAS, then these language agents collectively solve the problem of developing a shared communication system. How do these agents come to share a language system without central supervision? This question is investigated in AI experiments in which robots play language games, and as a result Steels observes that self-organization arises with a positive feedback loop in an open system. Steels (2000) posits the complexity paradigm in "stark opposition to the Chomskyan approach" (p. 8) to language origins.

Having established the premise of the complexity approach to language, Steels (2000) runs numerous experimental language games with robotic agents in an attempt to demonstrate how a lexicon could develop "from scratch" (p. 5). Steels (2000) identifies "speakers" and "hearers" (p. 5) that attempt to communicate what a given object is in their own codes. Based on feedback on the outcomes of these guessing games, the speakers and hearers update their scores. A winning association increases the scores, and a failed association decreases the score on a given lexical item. Steels (2000) describes this phenomenon as a "positive feedback loop between use and success" (p. 7), meaning the successful word associations propagate.

Summary of the Literature

Positive feedback loops are mentioned as a fundamental process in the scientific literature. Here the reader may find the best metaphors and models for applications in linguistics. In the education literature, studies conducted on the effects of teacher praise in the classroom suggest a potential impact of positive feedback. One shortcoming of these studies is the sole focus on the teacher as distributor of praise and/or feedback. It is possible for language learners to receive positive feedback from their peers as well as from their instructors. The teacher focus also prevails in the SLA literature, with the image of the omnipotent teacher as the sole issuer of corrective or negative feedback. Another shortcoming in the language learning literature is the limited types of positive feedback observed. Second language learning studies tend to focus on either praise or laughter, but not on both at once as part of a system. This study will focus on combined types of positive feedback at a high level of observation.

Clarification of Terms

These are the definitions intended for the following terms as used in the methodology and data analysis chapters of this thesis:

affirmation affirming that something said is true, indicated by markers "right," "correct," "true," "OK," and/or "yes" not uttered in response to a yes/no or direct question

feedback "language-related responses to learners' utterances, upon which the learner is focused and which can be used by the learner to validate or invalidate concepts he or she has about the target language" (Seliger, 1983, p. 258)

hearer the studied English language learner who is receiving spoken English feedback

input spoken language supplied to the English language learner

laughter when the speaker laughs at something said by the hearer

nonverbal cues nodding, gestures, thumbs-up, or other body language of an affirmative nature

output English Interlanguage (IL) spoken by the English language learner, often following input, feedback, or other prompt

praise evaluative feedback provided by a speaker, whether teacher or student, of a positive affective nature: indicated by praise markers "good," "great," "nice," and/or all preceding terms + "job" or "work"

speaker the teacher or student who is providing positive feedback to the hearer

target student the studied English language learner who is receiving spoken English feedback; hearer

token a counted instance of positive feedback given to the target student

uptake learner transfer from input to output; when the speaker asks the hearer about something said, or responds with new information (Nystrand et al., 1997, p. 39)

An Expanded Definition of Positive Feedback

To ensure that "positive feedback" is not confounded with "praise," the researcher offers an expanded definition of oral positive feedback, incorporating multiple definitions included in Imai (1989, p. 17). Positive feedback not only has a metalinguistic component (praise) but also a linguistic component (affirmation) and a paralinguistic component (laughter):

Positive Feedback

Spoken feedback of a positive affective nature. Positive feedback contains:

1) A *paralinguistic* component, such as "Normal conversational responses that one gives in face-to-face situations. Such responses as uh huh or head nodding convey agreement or that the message has been received and is understood … can be seen as forms of feedback" (Seliger, 1983, p. 258). Includes laughter and nonverbal cues, as defined.
2) A *linguistic* component, including the "personal response" (Imai, 1989, p. 17) —a mechanism of interpersonal communication that includes a speaker and hearer; manifested by affirmation as defined.
3) A *metalinguistic* component, taking the form of evaluative feedback, including praise markers such as "fine," "good," "excellent" (Vigil and Oller, 1976).

Chapter Three: Methodology

Setting

The data source for this study is digital class transcriptions from the Portland State University (PSU) Lab School. Operating in the Sixth Avenue Building in downtown Portland, Oregon, The PSU Lab School consists of two classrooms, each staffed by a Portland Community College instructor. The classrooms are separated by a recording room where observers may watch either of the classes live through two-way mirrors. The ESL classes are video-recorded digitally by six cameras in each classroom. All teachers wear radio microphones, as do two pairs of students each session. Students are seated in pairs, each pair at a separate table, regardless of microphone assignment. The microphone assignments are rotated among the students every class, such that a given student will not wear the microphone more often than any other Lab School student. Research assistants transcribe portions of recorded language, and code the classroom activities. Approximately 50 percent of recorded classes are coded by classroom participation pattern and type of activity.

Though classroom activities are normally teacher-directed, student IL is not elicited expressly. Students commonly improvise language in communicating about a given topic, yielding a significant body of naturalistic discourse data. Researchers can request coded information using a computer program, Query, designed for the Lab School corpus. According to Reder, Harris, and Setzler (2003), this software can be readily used to search for and play back video-audio clips that illustrate certain aspects of SLA and/or pedagogy. Class sessions that were not coded may also be viewed.

Subjects

Students attending Lab School ESL courses are adult English language learners. The courses are noncredit, offered by Portland Community College. Students are diverse by national origin. Following an initial placement test, students are placed in one of levels A, B, C, or D, with A being basic and D being advanced. IL is incipient at levels A and B, the levels observed in this study. Students may advance to a higher course level each term, pending instructor recommendation from work samples and/or test results. Teachers recommend student level promotion by student posttest performance results; informal classroom assessment; and perception of the student's motivation to pursue the higher level. Level advancement is a key indicator of progress in language acquisition, and is therefore the primary outcome measure in the data analysis. Students enjoy a high degree of confidentiality; researchers do not have direct access to the students, and the full names of the students are protected.

Procedures

The researcher observed all returned clips—portions of the classroom media with a specified end time and a specified camera angle—generated in response to researcher queries for selected students. Students were selected from a Lab School attendance list on the basis of having attended 3 consecutive university terms, each normally 10 weeks in length. Based on this criterion, 44 students had at the time of selection attended exactly 3 terms. Within this group, 21 students were promoted from their entry course level, and 23 were not. Therefore, odds are approximately 1 to 1 that

a given student was promoted a level within 3 terms. This length of attendance was selected for several reasons:

1) The learner promotion outcomes were the most evenly divided among this population, considering all matched populations from a minimum of 2 terms' attendance;

2) There were a sufficient number of students who attended 3 terms, and alternatively not a time-prohibitive volume of records to review;

3) There were enough data available for analysis over this time period; and

4) The 3-term attendance length was enough to control for unusually slow or rapid progress.

The researcher requested records of the classes during which the 3-term attendees were either wearing a microphone, or seated next to another wearer of a microphone. The start and finish *segment* overlap time for the records is 10 seconds by default. A segment, according to the 2003 "Using ClassAction" Pre-training Manual, is "a coded portion of the media containing a single code or transcribed utterance" (p. 2). The researcher observed the *playlists*—collections of clips that may be created in response to a query—for each target student's record. However, not all clips within each playlist contained either the target student, or target student IL. Clips containing target student IL were tracked and the others were not. Two entire playlists were rejected because they contained no clips for review, disqualifying the target learners in those cases. One playlist could not be located because a 3-term attendee on the attendance roster could not be identified in the Query list of student records.

For the data analysis, the following information was tracked: target student's (hearer's) first name; the observed session's date, room number, camera number, clip number and time length; whether the giver of positive feedback was a teacher (T) or student (S); and the classroom participation pattern. The predominant participation pattern was Pair, because transcription priority was granted to pairwork at the Lab School, but alternate participation patterns occurred: Free Movement, Group, Individual Private, Individual Public, Other, S (Student) Fronted Class, or T (Teacher) Fronted Class.

What counted as positive feedback? During pilot observations, the researcher viewed instances of several categories of positive feedback: praise ("good," "great," "nice," etc.), affirmation not given in response to a yes/no question ("yes," "correct," "OK"), laughter in response to something the learner said, and nonverbal cues (nodding, thumbs up, gestures indicating uptake). During the analytical observations, the researcher entered the segment start time in the appropriate observation rubric column (praise, affirmation, laughter, or nonverbal cues) in hours, minutes, and seconds if feedback occurred in that segment. Feedback classifications follow the definitions in the Clarification of Terms. The positive feedback must have been directed toward, not from, the target student to have been counted. In addition, the target student must have provided IL immediately before the positive feedback. For example, laughter was counted if it immediately followed the target student's IL, but was not counted if it followed the speaker's IL. See http://www.labschool.pdx.edu/Viewer/viewer.php?Maria3 to view Clip 31:

Clip 31 start class time 2:43:43
<Cecile1 (speaker)>: xxx (9) oh my god
(3) yes xxx job xxx eh eh sometime eh
(2) xxx
(3) <frn> what's it called
(3) ah yeah I think xxx no one come from my head after and
(3) ((sighs)) doctor xxx ooh
(1) xxx
(3) xxx no
(4) no ((laughs))

Since the laughter is self-induced, not in direct response to the hearer Maria3, it is not counted as positive feedback.

Positive feedback was entered by start time of transcription segment, not actual recorded time of occurrence. The exception to this notation occurred in situations including nontranscribed instances of positive feedback. In those cases, the researcher noted the actual recording time. Also, positive feedback was logged only by segment; that is, multiple feedbacks within a segment were counted only once. The utterance "yes yes yes" was counted as one token of affirmation, because it occurred within one segment, or discourse unit. In cases of different categories of positive feedback occurring within the same segment, the first type to occur in the segment was counted: for example, <speaker>: oh (laughs) yeah

contains both laughter and affirmation. Since both tokens occur within the same segment, the token of laughter was counted, but not the token of affirmation. This event rarely occurred in the transcriptions. Alternately, the researcher logged repeat positive feedback tokens from different segments that may have had contained some of the same data, as in these examples from the Maria3 playlist

http://www.labschool.pdx.edu/Viewer/viewer.php?Maria3:

Clip 19:	0:02:33 length	start class time 1:30:37
Token counted:	1:31:58	<Maria3 (target)>: oh. Is them.
Affirmation	1:32:00	<Cecile1 (speaker)>: *yeah*. To the

Clip 20:	0:00:29 length	start class time 1:31:37
Token counted:	1:31:58	<Maria3 (target)>: oh. Is them.
Affirmation	1:32:00	<Cecile1 (speaker)>: *yeah*. To the

While in this example the second clip falls entirely within the first one, many clips containing the same positive feedback tokens overlap at the time of the token, but not at start and end times. A clip containing a positive feedback token may start at an earlier recorded class time than another clip containing the same token. The first clip may have the token toward its end, whereas the second clip may contain the token toward its start and then run longer than the first clip, adding observation time. The overriding rule is that the clip contain target student IL to be counted toward the observed time totals for the student.

The researcher constructed 44 playlists of students who had attended exactly 3 terms at the PSU Lab School for review. A query was submitted for each of these data transcriptions, and the appropriate playlists were documented using an observation rubric (see Appendix A). With 3 playlists disqualified, data from the remaining 41 playlists are included in the data analysis.

Sample Observation Rubric

A facsimile table illustrating the observation rubric used follows. It contains the same observation categories as aforementioned.

Figure 1: Positive Feedback Observation Rubric—Facsimile

Stud-ent	**Date**	**Room** 204, 206	**Camera**	**Clip#**	**Length**	Affirm-ation	Praise	Laugh-ter	Non-verbal	**Source** S or T	**Part Pat**

The student is the receiver of the positive feedback. The date refers to that of the recorded class. The room number is required since classes run concurrently, so the date alone may not provide enough information to locate the student record. The camera is either #1 Left, abbreviated as "1L," or #6 Right, abbreviated as "6R." The clip number refers to the clip found in the target student's Playlist. Clip length is given in minutes and seconds. The segment start time entry was entered in full—hour, minutes, seconds—in the appropriate positive feedback type column. The source is the giver of the feedback—either "S," student, or "T," teacher. "Part Pat" refers to the coded classroom participation pattern, which was entered only for each instance of positive feedback.

Observation Rubric Interrater Reliability

To demonstrate the reliability of the data scoring, and to thwart a threat to internal design validity, a graduate student familiar with the Lab School software but uninvolved in the design was selected to observe Clip 50 of the Aching1 playlist (http://www.labschool.pdx.edu/Viewer/viewer.php?Aching1). This clip was chosen since it was observed to contain all four types of positive feedback: affirmation, praise, laughter, and nonverbal cues. The clip as reviewed by the researcher contained 10 tokens, indicated by the times entered thus:

Table 1: Positive Feedback by Type and Time for Aching1

Affirmation	Praise	Laughter	Nonverbal
0:31:51			
0:32:05			
			0:32:17
		0:32:26	
	0:32:30		
	0:32:39		
			0:32:55
		0:32:58	
0:33:48			
0:33:51			

Recall that the times noted refer to the start times of each clip given in hours, minutes, and seconds, which are not necessarily the actual class times during which the positive feedback tokens occurred.

The following is the result of the positive feedback interrater reliability test, with a check mark placed next to times that matched the original:

Table 2: Researcher and Rater Token Identification for Aching1

Affirmation	Praise	Laughter	Nonverbal
		0:31:04	
0:31:51√			
0:32:05 √			
		0:32:26 √	
	0:32:30 √		
	0:32:39 √		
0:33:41			
0:33:45			
			0:33:55
			0:34:01

The graduate student coder, after three independent trials, found the same quantity and types of positive feedback as the researcher. There is a discrepancy between certain token times logged, but the graduate coder explained that may be due to a habit of noting the actual times of occurrence of events in the recordings, not segment start times as used by the researcher.

In the data analysis, token times will not be factored into any tests, only the raw frequencies of tokens versus the total time observed for valid clips per student. Since the frequencies and types of feedback are identical in the interrater reliability test, the discrepancies in times logged will not affect the results described in this

study. Future related studies may wish to account for specific feedback rates received by target students—for example, the amount of time between feedback tokens—but the current analysis will review the overall rates of feedback, normalized against the observed clip time per student. In this regard, the interrater reliability test is successful, since the quantities and types of positive feedback noted by the rater, divided by the fixed time of Segment 50, will yield the same result reported by the researcher. As a consequence, it should be possible for another researcher to replicate this study, or for one to apply the design to a different data set. Additional samples of all four positive feedback token types may be observed in the Cam1 playlist (http://www.labschool.pdx.edu/Viewer/viewer.php?Cam1) for reference.

With the interrater reliability measure established, the observation rubric may be used to collect the appropriate data. During the analytical observations, the course level promotion outcomes were not consulted; promotion results for each student were determined afterward. Teachers recommended promotions on the basis of student posttest results, classroom assessments, and student motivation. How might the total rate of positive feedback received have affected these outcomes for the students? Is it possible that students who were promoted generally enjoyed higher frequencies of feedback? If so, under what circumstances are students receiving more feedback? Do peers or teachers tend to provide differing quantities of certain feedback types? To answer these research questions, the following hypotheses will be investigated.

Hypotheses

Hypothesis 1a) Mean rates of positive feedback will have a statistically significant effect on ESL student course level promotion. This is within the standards of 3 terms of course attendance and time-normalized feedback rates.

Null hypothesis: There is no effect of positive feedback on course level promotion.

Hypothesis 1b) If the null hypothesis of Hypothesis 1a is rejected, there exists a positive correlation between mean rate of time-normalized positive feedback and ESL course level promotion.

Null hypothesis: There is no significant positive correlation between feedback rate and ESL course level promotion.

Hypothesis 2a) Teachers tend to give more praise than affirmation to English language learners in comparison to other ESL students who are giving the same learners positive feedback.

Hypothesis 2b) ESL Students tend to give other ESL students more affirmation than praise when providing feedback, both in terms of raw frequencies and in comparison to time-normalized teacher feedback data.

All statistical tests are at prespecified alpha level .01, and are one-tailed. The *p* values will be the primary determiner of significance.

Chapter Four: Data Analysis

Summary of the Data Collection

The data collection began immediately following Human Subjects Research Review Committee (HSRRC) approval. The researcher reviewed 4861 clips in an effort to identify tokens of positive feedback. A majority of the clips, 63% (3075 of 4861), were rejected due to their lack of target student IL. This happened under these circumstances: The target student was not in the clip, typically off-camera in the same classroom; the target student was in the clip, but did not speak; or, the target student communicated only in his or her first language in the clip. The researcher counted positive feedback tokens only if they appeared to be in direct response to target student IL. A total of approximately 27.5 hours of clips were counted toward the observed times of the target students.

All clips had to be checked to note the presence of the target student; once the target student was located, the presence of target student IL needed to be confirmed. A total of 165 class sessions were observed and counted; at the Lab School stated rate of ten minutes of transcribed data per date ("Introduction to Transcription," www.labschool.pdx.edu), the counted yield of nearly 28 hours aligns with the estimated counted time of 27.5 hours (165 sessions x 10 minutes = 1650 minutes; 1650minutes/60 minutes per hour yield 27.5 hours). Therefore, entire sessions not containing transcribed data were rejected. In sum, 96 pages of observation rubrics were completed, the records containing a total of 1570 tokens of positive feedback.

Table 3: Summary of Observed Student Clip Time and Total Positive Feedback

Student	*n* Dates	Positive Feedback	Total Time	Feedback/Min.
1	3	19	0:30:23	0.6253
2	2	10	0:13:08	0.7614
3	5	89	0:40:21	2.2057
4	5	32	0:26:09	1.2237
5	6	37	0:58:09	0.6363
6	3	17	0:25:58	0.6547
7	6	64	1:03:47	1.0034
8	4	39	0:45:25	0.8587
9	6	98	1:00:45	1.6132
10	4	44	0:36:03	1.2205
11	2	22	0:20:10	1.0909
12	3	25	0:33:21	0.7496
13	9	76	1:17:26	0.9815
14	6	49	0:48:37	1.0079
15	1	7	0:09:37	0.7279
16	1	2	0:07:31	0.2661
17	2	37	0:26:41	1.3866
18	2	3	0:18:14	0.1645
19	8	107	1:43:31	1.0336
20	3	11	0:15:53	0.6925
21	9	156	1:51:21	1.4010
22	4	9	0:31:27	0.2862
23	3	13	0:38:26	0.3382
24	4	33	0:50:43	0.6507
25	2	34	0:21:34	1.5765
26	5	24	0:43:04	0.5573
27	4	50	0:46:45	1.0695
28	3	5	0:18:11	0.2750
29	2	17	0:28:29	0.5968
30	3	23	0:34:47	0.6612
31	1	1	0:16:11	0.0618
32	3	23	0:29:21	0.7836
33	3	27	0:32:12	0.8385
34	4	43	0:53:20	0.8063
35	5	40	0:53:03	0.7540
36	2	24	0:21:26	1.1198
37	8	63	1:35:31	0.6596
38	7	66	1:18:30	0.8408
39	3	40	0:29:12	1.3699
40	6	75	0:58:48	1.2755
41	3	16	0:25:45	0.6214
SUMMARY ***N* = 41**	***M* =** **4/Student**	**Feedback Tokens =** **1570**	**Time =** **27:59:15**	***M* =** **0.8646**

In Table 3, the first column refers to an arbitrarily assigned student number, for tracking purposes; the second column indicates the number of class dates under observation per given student; the third column is the total tokens of positive feedback received in response to IL; the fourth column represents the total time, in hours, minutes, and seconds, counted toward the given student; and the fifth column is the ratio created by dividing the total positive feedback tokens by the time in minutes, yielding a normalized frequency of positive feedback tokens for the student. Time-normalized data are expressed to four decimal places, allowing for a significant digit in the ones place, since the raw time data contain five significant digits.

Reading the bottom row of Table 3, one finds the number of students was 41; a mean of 4 dates and thus 40 minutes per student observed; a sum of 1570 tokens of positive feedback; the counted time in hours, minutes, and seconds; and a mean ratio of positive feedback per minute of 0.8646. On average, a student received nearly one instance of positive feedback for every minute he or she was engaged in dialogue using the English L2.

Before proceeding to the statistical tests of the hypotheses, which will be reported to three decimal places, it is useful to examine the types of positive feedback received, which relates to Hypotheses 2a and 2b. What types of feedback were the most or the least common? Interventions in the literature reviewed focused on teacher use of praise in the language classroom: The following results will turn that picture upside down.

Table 4: Summary of Positive Feedback Types and Tokens

Student	Affirmation	Praise	Laughter	Nonverbal	Total
1	11	2	2	4	19
2	8	0	2	0	10
3	70	3	9	7	89
4	9	5	5	13	32
5	16	1	20	0	37
6	11	3	2	1	17
7	38	11	12	3	64
8	27	0	12	0	39
9	56	2	18	22	98
10	32	0	4	8	44
11	17	2	3	0	22
12	10	7	8	0	25
13	48	4	12	12	76
14	22	4	13	10	49
15	4	0	3	0	7
16	2	0	0	0	2
17	30	0	4	3	37
18	3	0	0	0	3
19	80	6	21	0	107
20	7	3	0	1	11
21	88	18	40	10	156
22	3	3	3	0	9
23	4	2	6	1	13
24	18	1	11	3	33
25	27	5	0	2	34
26	21	1	1	1	24
27	48	0	2	0	50
28	3	0	0	2	5
29	7	1	7	2	17
30	17	0	4	2	23
31	1	0	0	0	1
32	15	0	8	0	23
33	16	0	11	0	27
34	32	1	10	0	43
35	36	2	2	0	40
36	20	0	4	0	24
37	28	4	23	8	63
38	25	25	12	4	66
39	34	2	4	0	40
40	65	1	4	5	75
41	9	4	3	0	16
SUMMARY ***N* = 41**	**Affirmation** **1018 (65%)**	**Praise** **123 (8%)**	**Laughter** **305 (19%)**	**Nonverbal** **124 (8%)**	**TOTAL** **1570 (100%)**

Table 4 shows the number of each type and total of positive feedback tokens per student. The four categories of positive feedback are shown along with the total tokens for each student. The grand totals and corresponding percents are displayed in the last row. Affirmation is certainly the most common type of positive feedback received by the target students, comprising 65% of all tokens. Among the remaining categories, with laughter comprises nearly a fifth of the positive feedback, and more importantly, praise and nonverbal cues (nodding) have an equal share of 8% apiece. The researcher must call attention in prior studies to the potential error of focusing on praise as the only independent variable, considering praise occurred in the current study as frequently as head nods—only 8% of the total feedback given. Praise is a tempting aspect of positive feedback to consider since it is so explicit—and therefore identifiable in observation—and easy for a practitioner to issue intentionally, as studied by Imai (1989) and Ward (1983).

The results in Table 4 indicate that praise could have a limited role in the creation of a positive feedback loop, since praise is not counted at all in 14 student records (34% of sample), and does not clearly appear to result in student course level promotion. The student who received the most praise by raw count, 25 tokens for student 38, failed to progress in course level within the 3-term window. Similarly, some students who failed to receive any praise during observations—for example, students 8, 10, 16, 17, 32, and 33—were able to increase their course level. These results suggest that praise, while potentially contributing to student course level promotion, should be considered as only one aspect of a positive feedback mechanism.

All four types of positive feedback will be included in the test of feedback rate and student course level promotion. Before doing so, the sources of positive feedback types are examined with respect to classroom role: teacher or student.

Review of Hypotheses 2a and 2b

During pilot observations, the researcher noted that student-to-student praise was very rare, and hypothesized that could be the case for the majority of student records. The sources of praise and affirmation are reviewed to characterize who is giving which types of feedback. Table 5 cites affirmation and praise tokens by source. The first column specifies the target student number, as in tables prior. Columns 2 and 3 contain tokens of affirmation and praise given to the target student *by other students*. Columns 4 and 5 show tokens of affirmation and praise given to the target student by a teacher.

Table 5: Summary of Affirmation and Praise Tokens

Student	S. Affirmation	S. Praise	T. Affirmation	T. Praise	Total
1	9	2	2	0	14
2	5	0	3	0	8
3	60	0	10	3	73
4	9	0	0	5	14
5	13	0	3	1	17
6	11	1	0	2	14
7	20	0	18	11	49
8	23	0	4	0	27
9	48	0	8	2	58
10	32	0	0	0	32
11	17	0	0	2	19
12	9	7	1	0	17
13	36	2	12	2	52
14	18	0	4	4	26
15	3	0	1	0	4
16	2	0	0	0	2
17	30	0	0	0	30
18	3	0	0	0	3
19	80	2	0	4	86
20	6	0	1	3	10
21	88	11	0	7	106
22	3	1	0	2	6
23	4	1	0	1	6
24	16	1	2	0	19
25	6	0	21	5	32
26	21	1	0	0	22
27	48	0	0	0	48
28	3	0	0	6	9
29	7	1	0	0	8
30	17	0	0	0	17
31	0	0	1	0	1
32	15	0	0	0	15
33	14	0	2	0	16
34	32	1	0	0	33
35	36	1	0	1	38
36	20	0	0	0	20
37	24	2	4	2	32
38	22	15	3	10	50
39	29	0	5	0	34
40	65	1	0	0	66
41	3	0	6	4	13
SUMMARY ***N* = 41**	**S. Affirmation** **907 (79%)**	**S. Praise** **50 (4%)**	**T. Affirmation** **111 (10%)**	**T. Praise** **77 (7%)**	**TOTAL** **1145 (100%)**

There are many zeroes in the praise columns. If calculated on individual bases, the resulting ratios of affirmation to praise would be illegal. It is not allowable under normal conditions to divide by zero. That is reason to avoid computation at the individual level, and instead focus on the collective results. In adding the columns, one can create meaningful ratios of affirmation to praise: The student-generated responses yield a ratio of 907 affirmations to 50 praises, and the teacher-driven tokens yield a ratio of 111 affirmations given to 77 praises. Simplified, the student affirmation to praise ratio is 18.14 affirmations per unit of praise, and the teacher affirmation to praise ratio is 1.44 affirmations per unit of praise.

For both students and teachers, the rate of affirmations exceeds that of praise. However, the students' rate of affirmation is approximately 12.5 times that of teachers'. The teacher ratio of affirmation to praise is closer to 1 to 1 than 2 to 1, indicating the tendency to praise is nearly as common as to affirm. In addition, the total teacher praise tokens exceed the total student praise tokens, although the teacher tokens in sum comprise only 16% of the total affirmations and praise tokens given.

Hypothesis 2a—that teachers tend to give more praise than affirmation to English language learners in comparison to other students who are giving the same learners positive feedback—is verified by the fact that teacher praise tokens (77) exceed that of student praise tokens (50). This is important given that teachers issued 16% (188 of 1145) of the total praise and affirmative tokens. Note that Hypothesis 2a does not state that teachers give more praise than affirmation; it compares the ratios of teacher- and student-generated tokens.

In the review of Hypothesis 2b—that students tend to give other students more affirmation than praise when providing feedback—the null hypothesis is rejected. The ratio of 907 affirmations to 50 praises issued by students appears to reflect the minor role of praise in cooperative second language learning. Student-issued praise composes 4% of the total affirmation and praise tokens, half of the overall praise rate of 8% for all categories as shown in Table 4. In evaluating the normalized student/teacher ratio comparison, we see that students affirmed at a ratio of 18.1 to each praise token while teachers affirmed 1.4 times per praise token. While the teacher ratio is close to one, the student ratio is indisputably in favor of affirmation.

The source of positive feedback is an issue worth considering within the framework of the positive feedback loop. If rate of positive feedback has a significant effect on course level promotion, as supported by the data, then it is important to note the source of the positive feedback to make recommendations for practice. If the data do not indicate a significant effect of feedback rate on course level promotion, then consideration of positive feedback sources will not be related to a broader picture of an influential positive feedback mechanism. To determine which of these options is correct, the presentation of the tests of Hypothesis 1a begins with Table 6, a summary of positive feedback and time observed for those students who were promoted at least one course level during the 3 observed terms:

Table 6: Total Positive Feedback and Time, Students Who Improved Course Level

Student	*n* Dates Obs.	+ Feedback	Total Time Obs.	+Feedback/Min.
3	5	89	0:40:21	2.2057
7	6	64	1:03:47	1.0034
8	4	39	0:45:25	0.8587
9	6	98	1:00:45	1.6132
10	4	44	0:36:03	1.2205
11	2	22	0:20:10	1.0909
12	3	25	0:33:21	0.7496
13	9	76	1:17:26	0.9815
14	6	49	0:48:37	1.0079
16	1	2	0:07:31	0.2661
17	2	37	0:26:41	1.3866
19	8	107	1:43:31	1.0336
21	9	156	1:51:21	1.4010
24	4	33	0:50:43	0.6507
25	2	34	0:21:34	1.5765
29	2	17	0:28:29	0.5968
32	3	23	0:29:21	0.7836
33	3	27	0:32:12	0.8385
35	5	40	0:53:03	0.7540
37	8	63	1:35:31	0.6596
***n* = 20**	***M* = 4.6**	***M* = 52.25**	***M* = 0:49:27**	***M* = 1.0339**

As in the prior tables, the student number is posted in the left-most column. These numbers were assigned alphabetically by the target students' first names, creating no discernable pattern related to course promotion. In the final row of Table 6 is a summary of data for those students whose course level improved within 3 terms. As forecast at the start of this study, the number $n = 20$ is close to 50% of the observed students (48.78%). The mean number of observed dates per student is 4.6, with a corresponding mean time observed of 49 minutes and 27 seconds. The total positive feedback mean is 52.25 instances per student, and the resulting total feedback rate in tokens per minute is 1.0339. Recall that the mean ratio for the entire group is 0.8646

tokens per minute, meaning students typically receive one instance of positive feedback for every minute they are using the English L2. Table 7 summarizes the corresponding rate of positive feedback received by the nonpromoted students:

Table 7: Total Positive Feedback and Time, Students Retaining Class Level

Student	*n* Dates Obs.	+ Feedback	Total Time Obs.	+Feedback/Min.
1	3	19	0:30:23	0.6253
2	2	10	0:13:08	0.7614
4	5	32	0:26:09	1.2237
5	6	37	0:58:09	0.6363
6	3	17	0:25:58	0.6547
15	1	7	0:09:37	0.7279
18	2	3	0:18:14	0.1645
20	3	11	0:15:53	0.6925
22	4	9	0:31:27	0.2862
23	3	13	0:38:26	0.3382
26	5	24	0:43:04	0.5573
27	4	50	0:46:45	1.0695
28	3	5	0:18:11	0.2750
30	3	23	0:34:47	0.6612
31	1	1	0:16:11	0.0618
34	4	43	0:53:20	0.8063
36	2	24	0:21:26	1.1198
38	7	66	1:18:30	0.8408
39	3	40	0:29:12	1.3699
40	6	75	0:58:48	1.2755
41	3	16	0:25:45	0.6214
***n* = 21**	***M* = 3.48**	***M* = 25.00**	***M* = 0:33:01**	***M* = 0.7033**

While some students in Table 7 received a considerable amount of positive feedback, for example, students 38 and 40, none received over 100 tokens, and none commanded a token per minute ratio of 2 to 1 or higher—in contrast with what was found in Table 6. Overall, the raw mean of positive feedback given to the nonpromoted students, 25, is less than 50% of that given to promoted students, 52.25.

Table 8: Comparison of Tokens, Promoted vs. Nonpromoted Students

	n	Mean Dates Observed per Student	Mean Positive Feedback Tokens	Mean Time Observed	Mean Time-normalized Positive Feedback Rate
Promoted	20	4.60	52.25	0:49:27	1.0339
Non-promoted	21	3.48	25.00	0:33:01	0.7033

The mean observation time is approximately 17 minutes less per nonpromoted student, though it is not a significant difference as tested in Appendix C. The last mean to be tested, the token per minute ratio, is noticeably lower. Although 0.7033 at a basic level rounds to one instead of zero, a more appropriate comparison for such a small interval scale is to think in terms of percentage. For example, the difference between a graduate thesis earning a 1.04 or 104% and a graduate thesis earning a .70 or 70% is the difference between an A+ and a C-. That translates to the difference between an exceptional performance on the assignment, and a performance below the graduate standard.

Multivariate Analysis

The objective of this thesis is to demonstrate that positive feedback is an important mechanism in facilitating SLA, whether it is actually causing the progression or not. All of the positive feedback in this study is generated in response to target student IL. Hence, the positive feedback in and of itself is not generating the student IL. Considering that some students were promoted while others were not within the same timeframe, are there salient student characteristics that may have influenced a higher base of IL? For example, what if persons of a certain gender or nationality were consistently promoted, while others were not? It is worth investigating a range of variables that may have had an effect on feedback rate and course promotion.

While the researcher did not have access to records of student L1 educational attainment, several notable dichotomies emerged in the sample. Recall that only A or B ESL level students were under observation. That means that a dichotomy exists in reference to a student's initial placement: A student in this study could have started at A level, coded as a "0," or B level, coded as a "1." Is there a discrepancy in the chances of a student being promoted from A level versus B level? According to Appendix D, given a start at A level, the conditional probability of course promotion for the students studied is .56. Given a start at B level, the conditional probability of course promotion is .38. These probabilities indicate that the initial course level should be considered a potentially intervening independent variable with respect to level promotion.

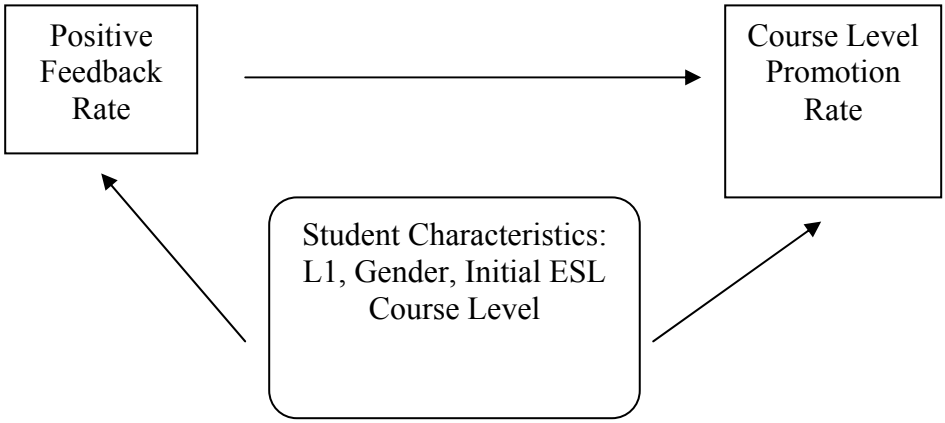
A second salient student characteristic is gender. Is there a significant difference in the chances a student was promoted a course level, given possession of a certain gender? Another dichotomy exists, by virtue of a student being male, coded as a "0," or female, coded as a "1." The number of female participants exceeds that of males by a ratio of nearly 2:1, but the chances of course level promotion do not. As found in Appendix D, the conditional probability of promotion given a student is male is .57, while the conditional probability of promotion given a student is female is .44.

A third dichotomous student characteristic is L1. Prior research (Larsen-Freeman & Long, 1991) has negated the notion of SLA being interfered with by a student's L1. Nevertheless, two major language groups were identified in the sample, Spanish, coded as a "0," and Asian (Chinese, Thai, and Korean)/Other languages (French, Farsi), coded as a "1." The joint probabilities of promotion are cited in Appendix D. All three student characteristics will thus be tested with respect to feedback rate.

Logic of the Analysis

To elucidate the ensuing statistical analysis, Figure 2 describes the interactive effects to be examined. By controlling the effects of student characteristics on both positive feedback rate and promotion, unbiased estimates can be made of the direct effects of feedback rate on promotion.

Figure 2: Interactive Effects to Be Examined



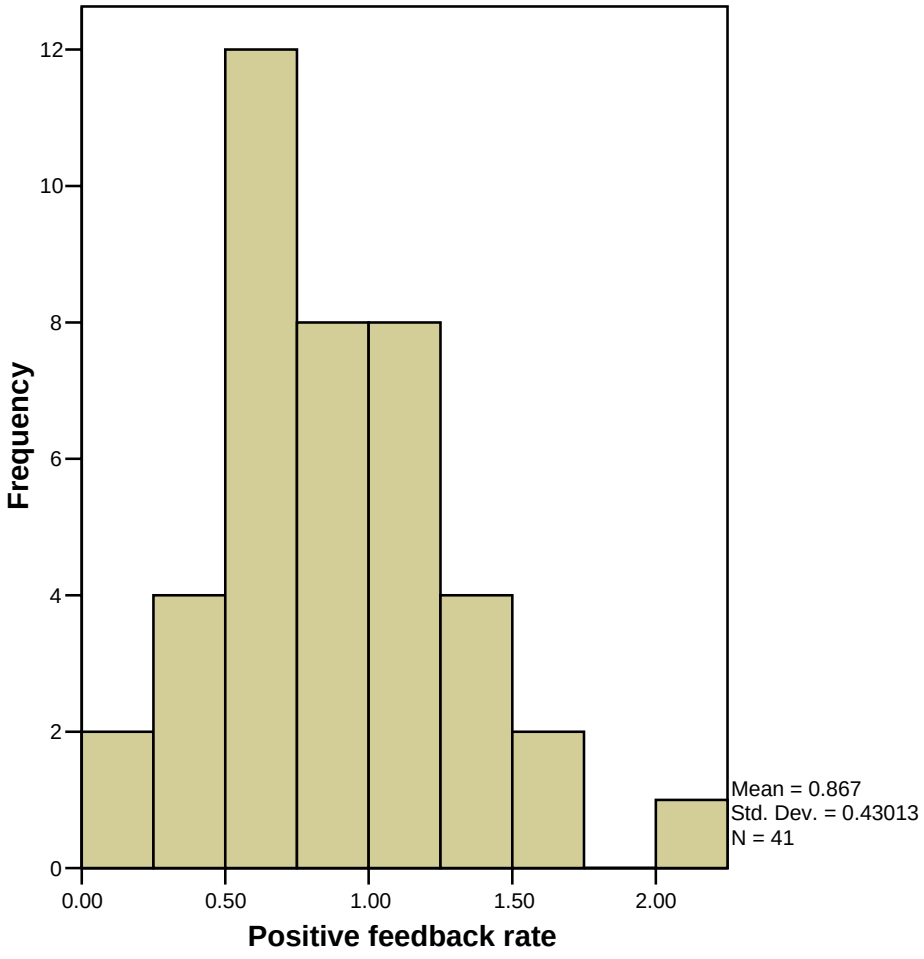
The central interest is on the effect of positive feedback rate on promotion. While probabilities have been projected for potential univariate effects of student characteristics on promotion, it is necessary to consider first the effects of student characteristics on feedback rate. For example, what if females received more affirmation than males, and in turn enjoyed a higher chance of promotion? The

appropriate test of potential student characteristic influences (independent dichotomous variables) on feedback rate (a dependent continuous variable) is multiple regression analysis. If this analysis demonstrates that positive feedback rate is independent of student characteristics, then it is appropriate to test the effect of feedback rate on promotion, while considering the student characteristics in the multivariate environment. With a dichotomous dependent variable promotion—which may be coded as "0" for "not promoted" or "1" for "promoted"—the correct analysis is logistic regression. This analysis is used for a dichotomous dependent variable, and allows for continuous (feedback rate) or dichotomous (course level, gender, L1) independent variables.

Multiple Linear Regression

To test the concurrent effects of student characteristics on received positive feedback rate, the researcher conducts a multivariate analysis of the effects of student characteristics—gender, course level, and L1—on positive feedback rate. By controlling the effects of student characteristics in a multivariate environment, we are better able to estimate the effects of feedback rate on promotion. Before proceeding, multiple linear regression analysis requires that the distribution of the positive feedback rate is approximately normal. According to Figure 3, the feedback rate data appear to be approximately normally distributed:

Figure 3: Feedback Rate



With the assumption of a normal curve met, it is appropriate to proceed with the multiple regression of feedback on student characteristics in a multivariate context. The effects of the three student characteristic variables—initial course level, gender, and first language—will be considered on the time-normalized rate of positive feedback received.

Table 9: Multiple Linear Regression Results

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.606	3	.202	1.100	.362[a]
	Residual	6.795	37	.184		
	Total	7.400	40			

a. Predictors: (Constant), L1, Starting Level, Gender

b. Dependent Variable: Positive feedback rate

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.737	.138		5.325	.000
	Starting Level	.063	.139	.072	.450	.655
	Gender	-.028	.148	-.031	-.188	.852
	L1	.253	.142	.298	1.780	.083

a. Dependent Variable: Positive feedback rate

Neither initial course level nor gender has a significant effect on the rate of feedback received, as indicated by their *p* values of .655 and .852. The overall ANOVA test in the initial multiple regression is similarly nonsignificant at alpha .01, further demonstrating that feedback rate is independent of these nominal student variables.

Although insignificant at alpha .01, L1 may have an effect on positive feedback rate, with a *p* value of .083. To test whether L1 is influencing the positive feedback rate, the multiple regression is conducted again without the independent variables of gender and starting level. The results are similar to the initial regression, with a *p* value of .08 for the effect of L1 on feedback rate.

Logistic Regression: Student Characteristics, Positive Feedback, and Promotion

Controlling the effects of feedback rate on student characteristics, we next test the effect of positive feedback rate and student characteristics on course level promotion. There are four independent variables. Feedback rate is an interval-scaled independent variable and starting course level, gender, and first language are dichotomous independent variables; as aforementioned, the appropriate test is logistic regression for the dichotomous dependent variable course promotion. The student characteristic independent variables were coded as follows: for course level, A level was coded as a "0" and B level was coded as a "1"; for gender, a male was coded as a "0" and female was coded as a "1"; for L1, Spanish was coded as a "0" and Asian or other language was coded as a "1." There were too few speakers of "other" languages to create a statistically meaningful third category for this sample.

Table 10: Logistic Regression Results Dependent Variable: Level Promotion

	Variables in the Equation	***B***	***SE B***	**Wald**	***df***	**Sig.**	**Exp(*B*)**
Step 1	Starting Level	-1.317	0.808	2.657	1	0.103	0.268
	Gender	-0.463	0.800	0.336	1	0.562	0.629
	L1	-1.203	0.863	1.942	1	0.163	0.300
	Positive Feedback Rate	3.152	1.206	6.829	1	0.009**	23.394
	Constant	-1.256	1.052	1.426	1	0.232	0.285

**$p < .01$.

Test of Hypothesis 1a

According to Table 10, only positive feedback rate is a significant predictor of course level promotion ($p = .009$) in this multivariate context at alpha level .01. The *B* coefficient for each nominal variable is negative, indicating a tendency for odds of less than one for the variable's effect on progression outcome (Pampel, 2000); additionally, these *B* coefficients are not statistically significant, and the corresponding variables should be dropped from the logistic model. In contrast, the positive *B* coefficient for the feedback rate interval variable indicates that increases in feedback increase the likelihood of course progression. The logit 3.152 indicates that a unit increase in feedback rate received will have a positive effect on the log odds. Decision: Reject the null hypothesis of 1a. Accept the alternate hypothesis: Increased rates of positive feedback have a statistically significant effect on promotion.

Test of Hypothesis 1b

The logistic analysis has shown that chances of course level promotion increase with increased levels of positive feedback. The logit 3.152 shall be considered the primary determiner of the strength of the effect of feedback rate. Other indicators of the strength of this association are the pseudo *r*-squares given in the logistic regression: .259 for the Cox & Snell *R* Square and .345 for the Nagelkerke *R* Square, a question may remain of the amount of variance between positive feedback rate and ESL course level promotion alone, since the pseudo *r*-squares by logistic regression include all dependent variables. However, the logistic regression allows for

both linear and nonlinear relationships among many variables. Correlation only reflects linear relationships between two variables. It is expected positive feedback may have nonlinear effects, and hence the logistic model is emphasized. Another similar measure is the point-biserial correlation coefficient (r_{pb} = .384) between positive feedback rate and level promotion, a value that is significant at alpha level .01 for 35 *df*. All of these measures indicate a significant positive relationship between feedback rate and promotion. The null hypothesis of 1b is rejected.

Chapter Five: Implications

A finding of increased chances of course level promotion accompanying higher rates of positive feedback indicates the potential existence of a positive feedback mechanism in the second language learning environment. The finding does not prove a causal relationship with learner progression, but the logistic regression results demonstrate that positive feedback rate is *an effective predictor* of course level promotion in a multivariate arena. A student receiving a unit increase of positive feedback per minute enjoys a marked increase in the odds of achieving promotion. The correlation between feedback rate alone and promotion, while positive and significant, indicates that factors other than positive feedback are likely involved in course progression.

Without successful student second language utterances, it is not likely that a student will receive the positive feedback. Other variables mentioned in the introduction—age, motivation, intelligence/aptitude, first language—are still working to influence the IL. However, the positive feedback mechanism is present among variable student characteristics, distinguishing itself as an effective predictor of success by promotion. The logic of CASs suggests that a positive feedback loop may be created between IL use and success, mirroring the larger-scale level progression. This self-similarity across scales, also known as *fractality*, is an important element of dynamic systems. Just as a branch of Douglas fir is by its shape an approximation of the grown tree, in the case of IL development one sees an increase in positive

responses to successful L2 utterances corresponding with overall IL level improvement. The systems model of IL follows Holland's (1998) example of the neural network using feedback to strengthen individual synapses, an activity leading to a stronger network overall. Increases in successful IL use yield higher levels of positive feedback, which in turn increase the chances the given student will move to a higher course level, yielding further opportunities for IL development—a positive feedback loop.

As stated by Larsen-Freeman (1997), in CASs, the behavior of the whole emerges out of the interaction of its parts. The multivariate analysis of the interaction of positive feedback rate and student characteristics is exploring the application of this notion. Through the interaction of feedback and other learner characteristics it is possible to push the IL system away from equilibrium—under this analogy, fossilization. Feedback rate could be viewed as an effective predicator of promotion not by virtue of its presence, but by its interactive effects with initial conditions and other learner variables.

This model is in contrast to the univariate view of IL modification that holds that a practitioner need only praise students more often to improve the students' skill levels. Here is an attempt to make a simple cause-and-effect link between one type of positive feedback and IL development. The premise is that if the ESL practitioner can give more praise or cause more laughter, the students' IL will improve by a corresponding rate. The results negate this claim for several reasons:

1) More than one type of positive feedback is likely required to attain the desired effects on IL, and affirmation is dominant in the data.
2) Authentic positive feedback, including virtually involuntary responses such as head nods, is more likely to have an impact on the language learner than praise that is forced or contingent. This is implied by the high frequency of affirmations counted during pairwork.
3) There are many variables in the SLA environment; this study accounted for a fraction of them (given highest *r* value .345 for the Nagelkerke *R* Square). The univariate models attempted to date do not account for the interactive effects of feedback and learner variables.
4) The observed students received the majority of their positive feedback from other students, while prior studies focus only on what teachers are doing. Additionally, students do not tend to praise (5% of student tokens) each other during pairwork.
5) Prior research relied on surveys or real-time classroom observations, which are not as reliable instruments as the digital recording reviews of the transcribed PSU Lab School data.

While the dynamic systems model of IL is not proven in this thesis, it is certainly viable, and may be supported by additional research. Should IL be determined to be a CAS, effects of variables such as feedback rate may not be in proportion to their distribution. The discrepancy between positive feedback rate's predictive value and its variance with promotion may be a point of expansion for further analysis, with

consideration of interactions of multiple variables.

Limitations

Some limitations of this study include the following:

1) The windows of observation—that is, approximately 10 transcribed minutes per real-time session—were relatively small. The transcriptions focused on pairwork, although other participation patterns such as Free Movement and T Fronted Class occurred. An analysis of participation patterns selected from a broader field of observations may yield further insight into the nature of the positive feedback mechanism. The longitudinal nature of this study, including observations to equal timeframes of 3 terms, was intended to control for a possible restrictive effect of the 10-minute observations of student IL.

2) While the observation period of 3 terms per student was appropriate for several reasons—there were enough attendees to allow for some diversity in student characteristics ($N = 41$), there was time allowed for some students to achieve progress, and there were sufficient data for review (approximately one hour's worth per student)—other timeframes are possible. The number of students who attended a certain number of terms could be described by a pyramid, with most Lab School students—nearly 80 in year 2004—at the bottom, having attended only 2 terms, then the 41 who attended only 3 terms, then roughly two dozen who attended only 4 terms, and at the top of the pyramid the handful of students who attended the Lab School for 5 or more terms. Analysis of the performance of 2-term Lab School attendees may

yield a result from that determined by the logistic regression of 3-term attendees.

3) Though the dyads studied included a variety of first languages spoken by the participants, some English language-learning environments contain a greater variety. It may be of interest to see the interactive effect of additional first languages on the positive feedback mechanism in the ESL learning environment. As indicated by the .08 *p* value for first languages tested in the multiple regression, the student's first languages appeared to have the greatest potential effect on positive feedback rate (of the student characteristics chosen for analysis).

4) Statistical analyses have demonstrated a potential impact of positive feedback in the ESL classroom, but they do not comprise a model of the mechanism. Since the actual positive feedback mechanism is likely nonlinear in its scope, nonlinear mathematical models such as partial differential equations utilized to describe chaotic attractors (Stewart, 2002) may provide additional insight in future research. A logistic model is an appropriate direction to take from the outset, since it uses iterative techniques essential in forming a positive feedback loop.

Could chaos/complexity theory simply be applied to any learning environment, as an all-encompassing "theory of everything" (Larsen-Freeman, 1997, p. 151)? The researcher responds that while not unique in its potential for the CAS model of learning, the ESL classroom is especially appropriate due to the emphasis on communication therein, and the students' need to use their ILs to do so, given their often differing first languages. ESL classrooms are also to be distinguished from secondary English L1 classes, which are "overwhelmingly monologic" in nature,

according to Nystrand et al. (1997, p. 33). With many opportunities for oral feedback in response to target language utterances, the ESL learning environment is especially consistent with the findings described in this thesis.

Future research

When does "the penny drop" (Sower, 1997, p. 2)? How much positive feedback does it take for it to have a significant effect on the student's IL? This is a question to be addressed in future research. All of the transcribed data for the students tracked in this study have been examined. Frequencies and rates of positive feedback for successful, long-term students could be compared using the available data; a comprehensive study would include additional transcription data collected.

Future research in related areas may explore the effects of additional characteristic variables, for example, student age and/or level of education in the first language. With a *p* value of .08 when tested against positive feedback rate, target student L1 is an area warranting further analysis. Assuming that positive feedback and the student characteristics explored account for a minority of the variance with course level promotion, it would be of interest to study the interactive effect of different characteristic variables on feedback rate.

Another vein of examination would be to look beyond the student characteristics considered and examine classroom characteristics. The communicative classroom with use of student-student dyads, a major feature of the PSU Lab School, would more likely yield the most opportunities for students to receive feedback. The

teacher-fronted class would minimize opportunities, since all communication must go through the teacher who is addressing the whole class at once. Affective variables such as classroom climate, classroom physical setup, classroom size, and number of students enrolled could be explored.

Suggestions for ESL Practitioners

Given the affirmation to praise ratios tallied in this study, praise constitutes a minority of the possible feedback types. Prior research (Ferguson & Houghton, 1992) found that praise initially positively impacted student classroom behavior, but as it decreased so did the desired on-task behaviors. Students are alert to rote positive feedback. During the data collection the researcher observed students giving each other mock praise, in teacher-like tones of voices: for example, "Vv-ayr-ee good!" Given the minimal role praise (8% of positive feedback observed overall) appears to have played in student promotion, it is recommended to avoid praising students merely for the fact of doing so. Genuine, deserved praise is certainly warranted on the appropriate occasion. But with Ferguson and Houghton's observation that at most teachers normally praised at a rate of .6667 tokens per minute, and with teacher praise comprising 5% of the total positive feedback observed in this study, chances are low that an increase in teacher praise will significantly add to the total positive feedback rate given to English language learners.

An alternative for practitioners to consider is issuing more affirmation to students. Since a significant effect of positive feedback rate on course promotion has

been proven, and students contribute to this rate largely by giving each other affirmation, teachers could more likely increase the rate of positive feedback by affirming correct IL utterances. In the observations teachers gave nearly as much praise as affirmation. A teacher's acknowledgement that a student is correct without using utterances of a metalinguistic, evaluative nature could be a transformative classroom event for the ESL student.

The logistic regression has demonstrated that positive feedback is associated with student course level promotion regardless of L1, initial level placement, or gender. Practitioners will want to keep this in mind as they create opportunities for classroom communication. What types of activities will maximize the possibilities for oral feedback? Which activities may minimize the prospects, potentially limiting IL development? Is there any relationship between participation patterns and rate of feedback? Future research may empirically demonstrate the appropriate methods to be used, but the results described in this thesis imply pairwork is effective in the language learning environment.

What Does This Mean for ESL Students

With students paired at the same introductory levels of English, it is not surprising that they may have difficulty praising each other. Many may not feel it is their place to evaluate their fellow students' work, leaving that duty to the teacher. Some may not have incorporated certain phrases such as "excellent work" into their

L2 lexicons, but all students observed could say “yes” or “yeah” to each other at any time desired. With affirmation as an instrumental force, the researcher suggests that students continue to support and recognize one another’s successes in use of the target language. Oral fluency will improve with conversational practice regardless of one’s inclination to speak. Outgoing and funny students (according to the amount of laughter they generated) received high levels of positive feedback as did reserved, serious students. The catalyst for earning positive feedback does not appear to be a certain personality type, but successful L2 use.

Conclusion

The same variables discussed in 40 years of SLA research—from cognitive and affective factors such as motivation, brain lateralization, aptitude, and attitude, to external influences such as access to other speakers of the target language, output opportunities, and comprehensible input—are still acting in myriad ways to affect a given learner’s IL. What is innovative is the notion that there is a positive feedback mechanism—working at the same cognitive area where much SLA is likely taking place—that interacts with these variables, potentially magnifying certain initial conditions to drive the learner’s IL, modeled here as a CAS, forward. Initial conditions, as observed over approximately 28 hours of data, could include having an empathetic listener, receiving praise or affirmation from a teacher or student, causing laughter amongst one’s classmates while using the IL, or successfully completing an L2 communicative task.

The finding of a significant effect of positive feedback rate on course level progression suggests that there could be a positive feedback mechanism helping to change the students' IL. Whether this means the IL is a CAS is open to discussion. However, since positive feedback plays a significant role in CASs, and this thesis has shown that positive feedback plays a statistically important role in IL development, one may deduce that by sharing this demonstrated property, in addition to the similarities mentioned in the study background, an IL should be modeled as a CAS.

The key idea to remember is that a Complex Adaptive System is more than the sum of its parts. Prior research failed to find a positive correlation between praise and IL improvement, as did studies attempting to evaluate the impact of laughter and affirmations in affective training. Once different aspects of positive feedback are considered in sum as part of one system—for example, a positive feedback mechanism operating to influence a Complex Adaptive System—the results sought become evident. This initial exploration has laid the groundwork for consideration of a model of Interlanguage as a Complex Adaptive System, and demonstrated a statistically significant effect of positive feedback rate on second language learning.

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Appendices

Appendix A: Positive Feedback Observation Rubric

Student	Date	Room	Camera	Clip #	Length	Positive Feedback by Type & Time				Source	Part Pat
		204, 206				Affirmation	Praise	Laughter	Nonverbal	S or T	

APPENDIX B

Positive Feedback per Minute Ratio

Level Improved	Level Retained
2.2057	0.6253
1.0034	0.7614
0.8587	1.2237
1.6132	0.6363
1.2205	0.6547
1.0909	0.7279
0.7496	0.1645
0.9815	0.6925
1.0079	0.2862
0.2661	0.3382
1.3866	0.5573
1.0336	1.0695
1.401	0.275
0.6507	0.6612
1.5765	0.0618
0.5968	0.8063
0.7836	1.1198
0.8385	0.8408
0.754	1.3699
0.6596	1.2755
	0.6214

t Test: Two-Sample Assuming Equal Variances

	Improved	*Retained*
Mean	1.0339	0.7033
Variance	0.193	0.131
Observations	20	21
Pooled Variance	0.161	
Hypothesized Mean Difference	0	
df	39	
t Stat	2.637	
P(T<=t) one-tail	0.006	
t Critical one-tail	2.426	

t Test: Two-Sample Assuming Unequal Variances

	Improved	*Retained*
Mean	1.0339	0.7033
Variance	0.193	0.131
Observations	20	21
Hypothesized Mean Difference	0	
df	37	
t Stat	2.624	
P(T<=t) one-tail	0.006	
t Critical one-tail	2.431	

Appendix C: Observed Time Mean Differences *t* Test

t Test for Observed Time Mean Differences

	Improved Course Level	Retained Course Level
Mean	49.443	33.017
Standard Deviation	28.717	17.833
Degrees of freedom	39	
T Statistic	2.212	
Critical Value	2.431	

Alpha .01

Appendix D: Joint Probability Tables of Student Characteristics

Joint Probability of Promotion per Student Placement Level

	A Level Start	B Level Start	Totals
Promoted	.34 (14)	.15 (6)	.49 (20)
Not Promoted	.27 (11)	.24 (10)	.51 (21)
Totals, w/in 3 Terms	.61 (25)	.39 (16)	1.00 (41)

Joint Probability of Promotion per Student Gender

	Male	Female	Totals
Promoted	.195 (8)	.290 (12)	.485 (20)
Not Promoted	.150 (6)	.365 (15)	.515 (21)
Totals, w/in 3 Terms	.345 (14)	.655 (27)	1.00 (41)

Joint Probability of Promotion per Student L1

	Spanish L1	Asian/Other L1	Totals
Promoted	.22 (9)	.27 (11)	.49 (20)
Not Promoted	.27 (11)	.24 (10)	.51 (21)
Totals, w/in 3 Terms	.49 (20)	.51 (21)	1.00 (41)

Conditional probabilities

P (promoted given Spanish L1) = .22/.49 = .45
P (promoted given Asian/Other L1) = .27/.51 = .53