Descriptions of Improvisational Thinking by Artist-Level Jazz Musicians
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Abstract
Thought processes of seven artist-level jazz musicians, each of whom recorded an improvised solo, were investigated. Immediately after completing their improvisations, participants listened to recordings of their playing and looked at the notation of their solos as they described in a directed interview the thinking processes that led to the realization of their improvisations. In all of the interviews, artists described making sketch plans, which outlined one or more musical features of upcoming passages. The artists also described monitoring and evaluating their own output as they performed, making judgments that often were incorporated into future planning. Four strategies used by the artists for generating the note content of the improvisations emerged from the analysis: recalling well-learned ideas from memory and inserting them into the ongoing improvisation, choosing notes based on a harmonic priority, choosing notes based on a melodic priority, and repeating material played in earlier sections of the improvisation.

Keywords
improvisation, jazz performance, cognition, jazz education

The act of musical improvisation is central to the jazz idiom (Schuller, 1968). Although jazz music comprises a number of stylistic conventions that distinguish it from other musics, it is the improvisatory element in jazz—the development and expression of musical ideas in the moment—that has defined jazz throughout its history (Gridley, 1987).

In the earliest incarnations of instrumental jazz, musicians learned to improvise through listening, imitation, and working alongside masters of the art form (Berliner, 1994). More recent initiates to jazz in America have learned to improvise through more...
formalized programs of jazz instruction. In addition to college jazz programs, many musicians are introduced to jazz improvisation through high school jazz bands and introductory college courses for nonjazz majors (Azzara, 2002). Consequently, the responsibility of continuing the tradition of jazz improvisation has shifted to the educator, which raises the question of how best to design authentic learning experiences.

Designing meaningful instruction for novices in any discipline is informed by understanding the thought processes of advanced practitioners (Bruner, 1977; Duke, 2005). But what is involved in the thinking of artist-level improvisers? If the study of technique and music theory fails to develop some components of this thinking, as some have suggested (Berliner, 1994; Kenny & Gellrich, 2002; Pressing, 1988; Sarath, 2002), is it possible to identify these components by studying artist-level improvisers?

The innumerable momentary decisions made by jazz improvisers are influenced by multiple factors. Note choices are guided by the accompanying chord structure and rhythmic feel and are influenced by preceding events and intended goals (Pressing, 1984). Rhythmic feel affects note placement, duration, melodic shape, and inflection. Interactions with other ensemble members add further complexity to the decision-making process.

The thought process guiding tonal jazz improvisation has been compared to the thinking that supports spoken language, because both are created in real time (Berkowitz, 2010; Berliner, 1994; Pressing, 1998). Word choice is guided by syntactic rules just as tonal improvisation is guided by melodic, rhythmic, and harmonic rules (Patel, 2003). Language production may pass through several stages in which an idea behind a phrase first is planned, then translated into linguistic structure, executed to create overt speech, and finally evaluated through a monitoring process (Levelt, Roelofs, & Meyer, 1999). Similarly, an improviser may conceptualize a musical goal initially, then formulate the goal according to the key and type of tune, decide upon and execute a motor plan, and finally evaluate the result (Berkowitz, 2010). Language also contains words and combinations of words that are part of a speaker’s vocabulary (Harley, 2008; Levelt et al., 1999). Similarly, improvisers accrue a collection of melodic figures that they incorporate into their improvisations (Berkowitz, 2010; Berliner, 1994; Finkelman, 1997; Owens, 1995; Pressing, 1998). At times, these figures are inserted into the improvisation note-for-note (Gushee, 1991). At other times, the improviser may use various procedures to create musical figures similar to those stored in long-term memory yet presented with alterations (Finkelman, 1997).

Speculative models have been proposed to explain how rules and vocabulary affect improvisational decision making (Clarke, 1988; Johnson-Laird, 2002; Kenny & Gellrich, 2002; Pressing, 1988). In one model, Pressing (1988) divided improvisations into collections of note groupings that he labeled “events.” Each event is triggered by a creative intention in the form of a mental schema that contains a cognitive image of sound and corresponding motor realization. As the mental schema is executed, the improviser compares the intention with the actual performed output through various feedback loops. New events often share features with preceding events, resulting in a
related set of note groupings. Yet, at times, the improviser may choose to interrupt the flow by initiating an event that is completely unrelated to the preceding event.

Johnson-Laird (2002) argued that note groupings are less important and instead focused on learned rules that dictate individual note choices as the main guiding principle of improvisation. He proposed that advanced improvisers have internalized so completely these rules that choices are made implicitly and with minimal use of working memory. This would leave the conscious mind free to focus on architectural aspects of the solo and interaction with other ensemble members. This model predicts that practitioners would describe focusing on structural considerations while individual note choices are made outside of consciousness.

One recent study using functional magnetic resonance imaging (fMRI) appears to support the notion that the improviser is not controlling all improvisational choices consciously (Limb & Braun, 2008). Limb and Braun compared the neural activations of expert jazz pianists while they improvised and while they performed memorized music. They found that the brain regions related to conscious decision making and self-monitoring (lateral orbitofrontal and dorsolateral prefrontal cortices) were less active during improvisation than during performance of memorized passages. In contrast, increased activation was seen in an area known to control behaviors that conform to internalized rules outside of conscious awareness (frontal polar portion of the medial prefrontal cortex). This area is associated with “organizing internally motivated, self-generated, and stimulus-independent behaviors” (p. 4). Limb and Braun’s results appear to support Johnson-Laird’s (2002) notion that choices during improvisation are made implicitly according to learned rules.

Artist-level thinking in jazz has been analyzed using qualitative methodologies (Berliner, 1994; Hargreaves, Cork, & Setton, 1991; Mendonça & Wallace, 2004; Monson, 1996). Berliner (1994) conducted a landmark study, based on interviews with over 50 renowned jazz artists, exploring learning environments and various aspects of improvisational thinking. The interviewees were asked questions about improvisation most often without reference to specific music examples, however, and their answers were seldom specific enough to illuminate their actual thought processes. Berliner provided specific music examples in solo transcriptions that illustrate some of the general findings of his study, locating the examples post hoc according to his interpretations of his informants’ comments.

Another qualitative study by Monson (1996) focused primarily on the interactive element of improvisation. In 14 interviews, Monson asked specific questions about actual music examples from her informants’ extant recordings, but the material had been recorded long before the interviews were conducted. Given the time between the recorded performances and the interviews about them, it seems unlikely that the musicians’ responses were accurate recollections of their thought processes at the moment of creation. Only one recent study employed a protocol in which the participants described their improvisational thinking immediately following their performances (Mendonça & Wallace, 2004). The focus of the study was to investigate the thinking
processes of musicians while improvising in a jazz duo in both tonal and atonal contexts. Analysis was done by assigning verbalizations to preset categories and comparing the number of verbalizations in each category across the tonal and free conditions. The participants spoke about their performances while listening and looking at video and did not have access to notation of their improvisations. The data reported deal primarily with the interactions between the two players in the duos.

A recently published study of cognition in classical improvisation combined qualitative research with historical analysis and neuroscientific data (Berkowitz, 2010). Berkowitz analyzed several historical treatises on improvisation and conducted interviews with two prominent improvisers in the classical idiom. He considered these findings in reference to brain imaging data that he collected as other classical pianists improvised simple melodies. Berkowitz’s conclusions are in line with much of the information reviewed above, including the performer’s use of prelearned fragments in an implicit process that is evaluated after execution.

The purpose of the present study was to describe the thinking processes underlying expert jazz improvisation. The rationale for the investigation was premised on the notion that descriptions of artist-level improvisers’ thinking may guide the development of improvisational activities in the classroom that would be beneficial and gratifying to all learners.

Artist-level jazz improvisers were asked to improvise on a known chord progression and were interviewed immediately afterward. I used as the basis for the interviews audio recordings and approximate transcriptions of their improvisations, which I produced immediately after their creation. I asked my informants to narrate their improvisational thinking processes as they listened to and watched the notation of their just-completed performances, linking comments to specific musical material. The limitations of previous qualitative research concerning specificity and time between performance and interview thereby were addressed by the current research design.

**Method**

Seven artist-level jazz improvisers participated in the study. Each artist had extensive experience in improvisation both in live settings and in the recording studio. All participants had produced professional audio recordings; all were active performers with busy performance careers in their local communities; and all had national and international touring experience. The participants performed on the following instruments: acoustic bass, violin, trumpet, piano, guitar, alto saxophone, and trombone. At the time of the study, the bassist, age 63, had been a mainstay of the East Coast jazz scene since the 1970s and had served as the director of a major university jazz program for 20 years. The Grammy-nominated violinist, age 54, was part of the West Coast jazz and bluegrass scene. The trumpeter, age 55, taught at a major Midwestern university and was active on the jazz scene of Kansas City. The trombonist, 36, was part of a nationally recognized big band and served on the faculty of a major university in Canada. The pianist, age 46; guitarist, age 55; and saxophonist, age 53, were on the
faculty of a major Southwestern university. All the participants were male. Selection of participants was based on availability and willingness to participate. The subject matter of the interviews was personal in nature, requiring a level of openness from the interviewees, who were not granted anonymity. The study protocol was approved by a university’s Institutional Review Board.

Each interview session had two major phases: the recording of the improvised solo and the interview concerning the solo just performed. I asked participants to perform a blues in F major using a melody of their choice, playing the melody first and then improvising a solo. The improvisations were accompanied by only a drum track. No particular version of the blues chord progression was specified, and no sheet music was shown to the participants. I asked the participants to play as many choruses as they wished before concluding their performances. The verbal directions read aloud to the participants were as follows:

Play a blues in F major in a medium-up tempo. Play a melody you are very familiar with followed by an improvisation on the blues form. Play long enough that you feel the performance has a formal sense to it. In other words, go until you feel like you can finish. You don’t have to decide the exact length beforehand.

All the performers in the study, except for the pianist, played along with a drum accompaniment that was played through speakers during the performance. I created the drum track accompaniment prior to the interviews by digitally looping two measures of a swing drum track taken from an existing recording (Carman, 1999). The performance tempo was 212 beats per minute.

Participants were recorded using a combination of software running on a laptop computer. A Shure SM-81 microphone was connected to a USB audio interface, which was connected to a laptop through the USB port. The audio recording software, Samplitude 9 Professional (Tost, 2007), rendered the audio in a wave file format. In the minutes following the recording phase of the session, I converted the audio file to a MIDI file using TS-Audio To MIDI Realtime Converter (Egorov, 2004). I then imported the MIDI file into the audio software, which allowed me to display the notation in synchrony with the original audio recording.

Each session was captured on video. The camera was positioned with the participant in view during the performance and with the computer screen in view during the interview.

During the interviews, I asked each participant to comment on the content of the recorded solo as he listened to the audio and looked at the notation, and I directed him to focus his verbal comments on aspects of decision making and structure. I read the following at the beginning of the interview:

As you are watching and listening to your performance, try to narrate your conscious thinking, considering questions like, “Where did that come from?” We are looking for a narration similar to a director’s commentary on a DVD. We
are particularly interested in how much of what you played comes from a repertoire or bank, how much is from a repertoire but modified in some way, and how much is material you never played before that is generated in the moment. We are also interested in the timing of decisions. Where are the decision points and what material does each decision affect?

I then played in sequence short sections of the improvised solo that corresponded to musical phrases, pausing after each phrase. Participants often described their thinking without prompting. When necessary, I asked questions to clarify the participants’ comments using the guidelines of responsive interviewing (Rubin & Rubin, 2005), which allow for follow-up questions to themes introduced by the interviewee and for probes to keep the conversation on topic. Other than the instructions listed above, no specific questions were prepared in advance.

A preliminary session with the pianist was conducted prior to the other interviews and was attended by the author and two additional researchers, all of whom asked questions. The additional researchers both had considerable research expertise and knowledge of jazz improvisation and served on the faculty of a major Southwestern university. This preliminary session was used as a model for later interviews. The musical task was selected and the verbal script used in later interviews was developed from questions and comments that arose in this interview. As indicated previously, the pianist did not play with a drum track. The tempo he chose was analyzed later and was used to develop the accompaniment track for subsequent sessions. The data from the pianist’s interview were incorporated into the analysis.

I began the analysis of the interviews by transcribing all verbal information, although I did not transcribe all utterances in detail. Concerning the level of detail necessary in transcriptions of verbal interviews, Rubin and Rubin (2005) recommend including only the details that are likely to be analyzed. I did not transcribe pauses, repeated individual words, and utterances such as “hmm” and “ahh” if they did not affect meaning.

The analysis of interview content was performed with the aid of the qualitative analysis software ATLAS.ti 5.2 (Muhr, 2006), which has several advantages related to organization and navigation as compared to manual indexing (Campbell, Connell, & Beegle, 2007). I assigned a code to each phrase, sentence, or paragraph in my transcriptions, according to the ideas expressed in each, using codes that emerged during the analysis (Strauss & Corbin, 1998). I assigned a total of 121 codes to 563 quotations within the seven interviews.

The process of identifying and coding conceptual categories has been described as a creative, interpretive process (Charmaz, 2006; Glaser, 1998) in which no standard form of analysis exists (Henwood & Pidgeon, 2003). To identify conceptual categories, the investigator compares “codes with codes (to generate a set of main themes) and then codes with data and data with data” in an interactive process (Henwood & Pidgeon, 2003, p. 148). As I analyzed these categories, I realized that participants often used different labels to describe the same phenomena. For example, the labels
Initially attached to comments referring to the use of material from a bank of ideas were “nuggets of stuff,” “units,” and “vocabulary dictated by history.” This process included frequent meetings with the two senior researchers in which all of us discussed and finally agreed on the emerging conceptual categories.

I also created exact transcriptions of all of the artists’ solos. The transcription software used during the interview sessions yielded inexact transcriptions of the recorded solos. In the final part of my analysis, I transcribed the improvised solos into fully accurate music notation and linked participants’ most salient verbalizations to the musical material with which they were associated. These transcriptions were checked for accuracy by a graduate student majoring in jazz performance.

The comparison of two main types of data, verbalizations and musical output, and the interpretations of three investigators constituted data triangulation in the current study. Triangulation “is often used as a qualitative equivalent of validity and reliability” (Willis, 2007, p. 218). The six main themes discussed in the Results section were identified both through the qualitative analysis of verbalizations and in the improvised musical output of the participants. Furthermore, the link between the verbal and musical output was supported by video data showing specifically where participants were pointing in the transcription of the improvisation as they described their thinking.

Although the analysis model known as grounded theory specifies that the researcher should not consider previous literature during the analysis to guide against bias (Glaser & Strauss, 1967), in reality, “theory cannot simply emerge from or reflect data, because interpretation and analysis is always conducted within some preexisting conceptual framework brought to the task by the analyst” (Henwood & Pidgeon, 2003, p. 134). It is possible that extensive knowledge of the literature concerning improvisation and the main researcher’s background in jazz performance and education influenced the analysis. In particular, the naming of the conceptual categories that serve as the main themes in the results may have been influenced by prior knowledge.

Results

Six main themes emerged from the analysis of the qualitative information. These themes reflect conceptual categories that emerged during my analysis. I determined the main themes based on the frequency with which they appeared and their broad applicability in describing the salient features of the artists’ performing and thinking. The results include a description of two ongoing processes: a sketch planning process and an evaluative monitoring process. These pertain to the forward-looking act of planning and the backward-looking act of monitoring what has just been played. In addition, I identified four strategies that served as the basis for the generation of musical material: the use of memorized music, which I refer to as an idea bank; the selection of notes with particular attention to the harmonic structure of the music, which I refer to as harmonic priority; the selection of notes with particular attention to the shape of the melodic line, which I refer to as melodic priority; and the recall of music played earlier in the solo, which then is incorporated into the ongoing line.
I describe these processes in detail below. With each description, I provide examples from individual participants that illustrate each idea.

**Sketch Planning**

In the process of sketch planning, one or more musical features of upcoming passages are conceived by the improviser before the passages’ performance. These features include architectural elements like note density, instrument register, and harmonic structure. In all instances of sketch planning, the improviser is aware of these features before the passage is played. Every participant in the study described planning upcoming aspects of his solo. Across the seven interviews, the artists described a total of 43 instances of sketch planning.

The trombonist, for example, described knowing that his second solo chorus would “string more linear stuff together.” During the chorus, he played longer eighth-note lines, departing from the shorter, simpler rhythmic figure that dominated his first improvised chorus. The trombonist clearly had a plan for the second chorus, but it included only incomplete information. According to his comments, note density was an important aspect of the second chorus and was an essential feature of the architecture of the solo; he planned to use eighth-note lines, but decisions about pitch were not made ahead of the performance of each phrase.

In some instances, improvisers described sketching out upcoming passages in several stages that became progressively more detailed with the passage of time. The guitarist, for example, explained how he planned to “stretch the listener’s ear” at one point in his solo, an effect he accomplished by using pitches from outside the key. During the interview, he clearly stated that he had not determined the device he would use to “stretch” at the time he derived his sketch. He identified the point at which he made the decision to use nonchord tones, which occurred several beats after the decision to stretch (see Figure 1). The guitarist chose to add harmonic tension by using pitches derived from the altered scale before deciding which pitches to use. He explained that he chose which notes to play in the moment while the passage was being performed. In the excerpt in Figure 1, what began as the sketch became progressively more explicit: stretch the listener, use a dissonant scale, and select pitches from the scale.
Evaluative Monitoring

The second ongoing process I identified in the thinking of the participants was an evaluative monitoring process. Improvisers described monitoring and evaluating their own playing as they performed and using that information in subsequent decision making. I identified 23 instances of the monitoring process in five of the seven transcriptions.

Interestingly, several participants indicated that this monitoring revealed notes that were “unexpected,” suggesting that improvisers are at times not fully aware of the sounds they are about to play. The violinist, for example, explained how he monitored his playing to identify interesting material: “The hand is gonna crawl around . . . and the brain is gonna like try to pick out something that the hand is doing.” The pianist described a similar process: “Hopefully something pops up that’s worth doing something with.” In all cases, it appears that the process the improvisers described is separate from the conscious control of physical movements. When the violinist describes the hand as “crawling around” and “the brain” as picking out material, he gives the impression that the brain is monitoring what the hand is doing and the hand is not under conscious control.

In another example, the bassist referred to a melodic variation by saying, “I hear myself doing that.” His comment concerned the improvised bass line in the first measure of his second chorus, where the pitches do not appear to match the underlying F chord (see Figure 2). The figure is based on the F triad, but the placement is shifted rhythmically. The figure starts with a chromatic approach note on Beat 1, and the root, F, does not appear until the third beat. This creates melodic tension that he resolves five measures later on the Bb chord by placing the root on the first beat. The bassist’s comment implies that this effect was not planned but instead occurred without deliberate thought and that he was reacting to the sounds he heard coming from his own instrument, noting how his own line had added tension and therefore needed to “be resolved.”

The lack of deliberative control sometimes results in improvisational outcomes that improvisers label as errors. In one example, the bassist pointed out how an improvised line ended unexpectedly. “I got there too soon or sooner than I would have liked, so you have to be a helicopter and kind of hover around. I had to fix that, whatever that is.” The unexpected occurrence had to be accommodated by altering subsequent
improvised material. The bassist simply incorporated the end of the melodic line that ended unexpectedly into the following phrase. The result is improvised material that appears perfectly coherent, even though it derived from an unexpected event.

Four Generative Strategies

The two processes described above represent thinking that appears to be ongoing throughout the creation of each improvisation, but the processes do not describe how musical material is initially conceived. From the participant interviews, I identified four generative strategies that describe ways of creating improvised material—making choices about which notes to play. Improvisers seemed to switch from one generative strategy to another at different times during their solos, and the amount of material created using each generative strategy differed among participants. Using material from an idea bank is a flexible way of incorporating practiced musical elements into a solo. I define the idea bank as the collection of procedural and auditory memories of coherent musical structures, which may vary in explicitness and extent. I found 76 instances in which participants described drawing material from an idea bank.

Some ideas from the idea bank are inserted as they are recalled, with no modifications from the memory stored. The pianist, for example, described inserting complete remembered ideas in parts of his solo (see Figure 3). He labeled these figures “units,” which he can replicate exactly in multiple contexts. Regarding the excerpt, the pianist described his improvisational thinking as connecting smaller units to form longer lines. He compared this to building with Legos, in which creation is a process of connecting pre-formed blocks.

Several participants mentioned using melodic figures that were unique versions of learned models, accessing a learned melodic figure from long-term memory and adapting it to fit the current context. Some participants referred to this phenomenon as using a model. The model may have all the information needed to perform an actual
melodic figure, but the context requires the improviser to modify the version stored in memory. The trombonist, for example, described how he learned to play over a particular set of chords in the seventh and eighth bars of the blues by memorizing a model played by Kenny Dorham that uses an advanced harmonic device referred to as a tritone substitution. The trombonist described a melodic figure in his solo as an adaptation of the model as played by Dorham (see Figure 4).

In some cases, the ideas recalled from the idea bank are only templates or outlines. The alto saxophonist, for example, explained how he constructed a melodic figure using a memorized melodic contour as a template. “I’m using a rising scale and then when the five chord hits that diminished triad that we map on to the dominant chord . . . it is a general shape . . . a scale orientation of the two chord and an arpeggiated version of the five chord.” He asserted that the version of the template in this instance was unique and he had not played it previously.

The improvisers sometimes referred to vague stylistic features as guiding their creation of musical figures. These ideas from the idea bank are inexplicit memories of sounds or effects. In one instance, for example, the trombonist described how a melodic figure ends “the way Parker ends phrases.” Yet, when asked to define these features, he referred only to inexplicit labels like “cool” and “laid back.”

Harmonic priority is the generative strategy defined by selecting pitches with attention focused on the music’s chordal structures. When improvising with harmonic priority, improvisers create melodic lines by shaping melodic material to fit the chord structure. Participants who described improvising with harmonic priority identified “target notes” among available chord tones and created melodic passages that placed these targets on the strong beats of the measure. I identified 91 musical examples illustrating the use of harmonic priority as a generative strategy.

Figure 5 shows a long eighth-note line that, according to the guitarist, was created using harmonic priority as a generative strategy. In the example, all the chord tones are circled, and the chord tones that appear on Beats 1 and 3 are marked with arrows. The example illustrates the prevalence of chord tones on strong beats. The few measures that feature non chord tones on the strong beats introduce tension that is resolved in subsequent measures with chord tones again placed on the strong beats. The guitarist described his thinking process as “weaving through the changes.”

**Figure 4.** Illustration shows a figure adapted from a model
Note: Excerpt from the trombonist’s solo, mm. 54–57, with relevant comments from his interview.
When artists improvise with *melodic priority*, they devote less attention to the underlying chord progression and focus more on the horizontal features of the improvised material. This often results in melodies based on a single scale that span several chord changes. This approach is described by one participant as “blanketing.”

When discussing the use of melodic priority, participants often mentioned disregarding the harmonic underpinnings of the blues progression. The trombonist described this linear process as “singing” and indicated that he did not consciously consider chord information as he played (see Figure 6). Fewer musical examples of the melodic priority generative strategy were identified in the transcriptions compared to the other strategies. Nine examples were identified in three of the seven transcriptions.

The fourth generative strategy involves repeating material played earlier in the solo, either exactly or with modifications. Several improvised solos included examples where melodic figures are repeated with minor modifications. In one example, the pianist repeated a short rhythmic figure four times with alterations that implied the underlying chord progression. I identified 27 examples in which the improviser repeated material played earlier in the same solo.

The violinist spoke about relating his entire solo to a short melodic theme that he identified in the second solo chorus. Throughout the rest of the solo, he pointed out

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**Figure 5.** Illustration shows an eighth-note line created with the harmonic priority generative strategy

Note: The circled notes denote chord tones and the arrows point to chord tones on Beats 1 and 3. Excerpt from the guitarist’s solo, mm. 29–36. Note that the F major chord in m. 35 is anticipated in the end of m. 34.

**Figure 6.** Illustration of melodic priority

Note: Excerpt from the trombonist’s solo, mm. 92–95, with relevant comment from his interview.
instances where he incorporated this theme. The excerpt in Figure 7 indicates where he identified the melodic figure that became the theme for the rest of his solo. Figure 8 illustrates how this figure is used several choruses later. It appears that the decision to incorporate the figure later in the improvisation was made after the figure was performed. This suggests that the evaluative monitoring process mentioned previously plays a role in decisions about repeating material in the solo.

Discussion

I identified six main themes that capture the various thought processes engaged by expert improvisers. I obtained the results through retrospective verbal reports in which the improvisers described their own thinking as they viewed notation and listened to their improvisations minutes after they had been performed. The procedures allowed me to link the participants’ verbal comments to specific musical material. This investigation represents the first time that improvisers answered questions about their behavior while looking at notation of their just-completed performances. It should be acknowledged that the participants’ descriptions were based on reflections about their own thinking and may not fully reflect their thoughts during their improvisations.

There are intriguing parallels between published models of improvisation and themes identified in the current study. Two theoretical models mentioned earlier describe how decisions may occur either at specific time points between note groupings (Pressing, 1988) or continuously as notes are chosen implicitly according to internalized rules (Johnson-Laird, 2002). The current study suggests that improvisers may use both processes at different times.

Pressing’s (1988) observation that notes are chosen in groups is consistent with participants’ descriptions of drawing intact motives from a memorized idea bank. In
most instances observed in these improvisations, ideas were not inserted note for note but were adapted in accordance with the harmonic, melodic, and stylistic contexts in which they were applied. The decision to insert a group of notes into a solo line sets in motion the recall of a procedural memory that plays out until the note grouping is completed. Pressing labeled these decision points “triggers” and described how auditory and proprioceptive feedback loops are used to shape subsequent note groupings at each successive trigger. This is similar to the current participants’ descriptions of monitoring the outcome and using the information to make sketch plans for upcoming material. A related observation was made by Berkowitz (2010), who explained that “as the execution of the musical goal takes place, the performer must monitor the result through both aural and kinesthetic feedback” (p. 147). In addition, Pressing pointed out that improvisers sometimes repeat ideas in various forms just as current participants described using material repeatedly throughout their solos.

The harmonic and melodic priority generative strategies are consistent with Johnson-Laird’s (2002) theory of internalized implicit rules as the main guiding force behind note choices. Participants in the current study described creating longer lines that aligned with the chord progression without focusing on individual note choices. For example, the pianist described the thought behind a line that clearly reflected the underlying harmonic structure as being concerned with the contour of the line: “I think what I think about there is like ‘How can I gracefully get down from this register?’ you know, and then secondarily to that, okay, I’m gonna play notes that reflect the chords of the blues.” This implies that selecting notes that fit the harmonic progression requires little effort and that the improviser is focused mainly on shaping the melodic contour. Similarly, using melodic priority, the bassist described, “I’m following the shape of my line. I don’t really know where it’s gonna take me.” Internalized melodic rules appear to shape the line continuously outside of conscious control while the improviser monitors the outcome.

The processing speed necessary to create improvisations in real time also suggests that individual notes are not chosen consciously (Dietrich, 2004; Johnson-Laird, 2002; Kenny & Gellrich, 2002; Pressing, 1988), and participants in the current study described feelings of automaticity during their improvisation. Berkowitz (2010) referred to the phenomenon as “creator and witness” in which the improviser creates notes with a fast implicit process that is witnessed by the conscious mind only after the notes are played. This notion is supported by brain imaging data that suggests that the part of the brain that is active during conscious decision making is less engaged during improvisation than during the performance of learned material (Limb & Braun, 2008).

Although individual notes may be chosen implicitly, the current study suggests that those choices may be guided consciously by the overall goal of creating architecturally interesting improvisations. The pianist described how he often starts a blues improvisation by visualizing a “solo curve”: “Start the solo with sparse melodic material, develop this material in subsequent choruses building to an emotional peak in the second to last chorus, and finally ‘wind down’ in the last chorus.” Participants in the Limb and Braun (2008) study listened to a prerecorded accompaniment and were not asked to...
create improvisations with an architectural structure, possibly accounting for the deactivation in the brain regions associated with conscious decision making.

In an actual jazz performance, the improviser may be engaged primarily in interaction with other ensemble members (Berliner, 1994; Monson, 1996; Sawyer, 1992). Most of the comments in the study of jazz duos by Mendonça and Wallace (2004) concerned how interaction affected decisions. Interaction was eliminated as a factor both in the current study and in the study by Limb and Braun (2008). Further research should explore the effects of larger architectural plans and interactivity on improvisational behavior and thinking.

**Implications for Music Education**

It has been argued that traditional jazz instruction emphasizes music theory at the expense of structural and interactive concerns (Kenny & Gellrich, 2002; Pressing, 1988; Sarath, 2002). As a result, novice jazz improvisers may develop thinking patterns that focus on individual note choices in ways that are unlike the thinking of skillful improvisers. Although knowledge of jazz theory may be common among jazz artists, so are skills related to compositional architecture and interaction among performers.

With this in mind, it may be that aspiring jazz musicians would benefit from working among several different modes of thinking. For example, (1) a “theory mode” that explores the idea bank and harmonic priority generative strategies, with conscious attention focused on technical and theoretical concepts, and (2) a “play mode” that focuses on planning and evaluative processes in addition to interaction with other students and teachers.

Instruction in theory mode could include the deliberate building of the idea bank and procedures for improvisation using harmonic priority. Traditional jazz pedagogical materials often are designed to develop the idea bank and teach students to emphasize chord tones in their improvisations (e.g., Baker, 1988; Coker, 1980). Techniques for learning to use prelearned fragments include deliberately inserting a particular figure in the improvisation at a spot that fits the chordal structure, such as the trombonist described in the current study using a learned Kenny Dorham figure. The goal of instruction in theory mode should be that the student through practice will learn to use these techniques without conscious effort.

Instruction in play mode could cultivate the ability to improvise coherently by explicitly structuring student learning activities that do not require conscious attention to the chord structure. Activities in play mode could include planning and executing longer solo structures using effects such as note density and register similar to the plan described by the pianist in the current study. Central to the idea of play mode is that the chordal structure accompanying the improvisational activities should be so familiar to the student that all attention can be focused on planning, monitoring, and interactive processes.

The results of the current study also could be used to design meaningful introductory improvisation exercises for band and orchestra students. This study’s results
suggest that experts are concerned primarily with planning and monitoring their own output in order to create structurally sound improvisations. Actual note choices are guided by practiced implicit processes that rely on a bank of ideas and procedures for creating melodically and harmonically appropriate musical material. Students who engage in introductory improvisation exercises do not have such a bank of material and processes to rely on. However, simply growing up in the Western musical culture appears to support basic improvisation without prior improvisational instruction (Baldi, Tafuri, & Caterina, 2002; Brophy, 2005; Kiehn, 2003; Kiehn & Bay, 2007). Some of the improvisation exercises used in this research with young students could be transferred to the band or orchestra classroom. Brophy (2005) constructed a class setting in which all students took turns improvising on a xylophone using a scale in which all available notes fit the accompaniment. Similarly, a diatonic chordal accompaniment could be used in exercises that provide orchestra or band students an opportunity to improvise individually using a familiar scale. This would allow instruction to be focused on the use of motives and the development of phrases and to demonstrate how improvisers can monitor their output to choose ideas for further development.

The primary goal of improvisation instruction should be to structure learning activities in which students at all levels can experience ways of thinking that resemble those of artist-level improvisers. Accomplishing this goal requires that we more closely examine and more clearly describe not only what experts do but also how they think about what they do. The research described in this report provides a new perspective on improvisational thinking and may help illuminate the covert planning and decision making that lead to artistic creation in jazz.

Author’s Note

This article is based on the author’s dissertation, “Descriptions of Improvisational Thinking by Artist-Level Jazz Musicians,” completed at The University of Texas at Austin in 2008.

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