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The Relationship Between Affect and Performance in Competitive Intercollegiate Tennis: A Dynamic Conceptualization and Application

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A recently introduced probabilistic methodology (Kamata, Tenenbaum, & Hanin, 2002) was implemented in the current study to ascertain the idiosyncratic Individual Affect-related Performance Zones (IAPZs) of four intercollegiate tennis players. The current study advances upon previous empirical works by its use of multiple performance levels, use of athletes' introspective affective intensity, and recording multiple data points *during* competition. Results present within- and between-player comparisons, and highlight the dynamic nature of competitive athletic events. A brief discussion regarding the implications of this methodology and the pursuant results for sport psychology consultants is also proffered. Being idiosyncratic in nature, the observations from this study are not intended to generalize across samples, but rather to introduce how knowledge of the systematic and dynamic linkage between an individual's affect and his or her performance can be uncovered and possibly used with individual athletes to facilitate more consistently optimal performances.

Key Words: introspective recall, momentum states, core affect, probabilistic methodology

At the turn of the 20th century, Yerkes and Dodson (1908) illustrated the Inverted-U concept, which identifies a relationship between an individual's anxiety level and his or her physical performance level. The Inverted-U concept notes that as anxiety increases so does performance, up to a point. Once the individual's anxiety level increases beyond that intrapersonal and domain-relevant point, performance then declines. More recent research submits a congruent view: Given a certain level of physical preparedness, an athlete's chance of achieving his or her optimal

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performance depends on that person being in an "appropriate" subjective emotional state (Vallerand, 1983). Further investigations have also found support for the notion that an athlete's anxiety level, as an example of one emotion, impacts his or her performance quality (Burton, 1988; Gould, Petlichkoff, Simons, & Vevera, 1987; Jones, Swain, & Cale, 1991). Hanin (2000) advanced this line of research with the concept of Individual Zones of Optimal Functioning (IZOF), which illustrates a link between one's emotional states and his or her performance level via retrospective recall of subjective emotional experiences. These empirical works are congruent with Lazarus and Folkman's (1984) contention that one's performance varies as a function of his or her emotional state at a particular point in time because of the idiosyncratic coping mechanisms and self-regulating strategies he or she employs at that time.

In addition to the literature addressing the intrapersonal factors (e.g., subjectively reported levels of anxiety) that are related to performance, Bar-Eli and Tenenbaum (1989) introduced the notion of momentum states. Momentum states are reportedly: (a) dynamic and domain-specific components of athletic competition; and (b) factors that can greatly impact performance depending on a participant's perceptions of the situation, on his or her belief in his or her ability to cope with that situation, and on his or her available self-regulatory strategies. When combined with the notion of an emotion-performance relationship, the idea of momentum states becomes increasingly salient to sport psychology work. The current study collected data during competition in order to analyze each player's momentum states, thereby expanding on the previous affect-performance literature.

Previous research has investigated the relationship between various emotions and performance using methodologies that can be improved upon. For example, in order to implement the IZOF (Hanin, 2000) concept, an individual must recall how he or she was feeling immediately before earlier competitions (i.e., recall the specific emotions and the intensity of each emotion he or she was experiencing at some pre-competitive moment). This can be potentially problematic since: (a) the outcome of an event may unduly influence the recall of emotions relative to that competition; (b) emotions tend to be a reaction to, and directed at an object (Spielberger, 1972), which may or may not be related to the individual's core affective state (Russell, 2003); and (c) pre-competition emotional states ignore the potentially salient notion of momentum states during a competition. Furthermore, Hanin acknowledged that there is a high degree of variability among individuals in both the content and intensity of their emotions associated with successful and unsuccessful performances. Therefore, instead of monitoring "emotions" (e.g., fear, anxiety, or happiness), the current study demonstrates the utility of using an idiosyncratically generalizable concept that comprehensively represents emotions, that is, *affect*. According to Watson and Tellegen (1985), emotions and feelings are collectively considered part of a broader psychological concept termed *affect*, which can be conceptualized along two primary dimensions: arousal and pleasure (Russell, Weiss, & Mendelsohn, 1989). More recently, Russell (2003) reported that these "core affect" states (i.e., feeling good or bad, energized, or relaxed) influence reflexes, perception, cognition, and behavior. This circumplex model operationalizing the concept of core affect is represented in a two-dimensional space defined by hedonic tone (i.e., pleasure) and activation (i.e., arousal), and is one of the foundations upon which the current study was constructed.

Four recent studies (e.g., Cohen, Tenenbaum, & English, 2006; Edmonds, Tenenbaum, Mann, Johnson, & Kamata, under review; Golden, Tenenbaum, & Kamata, 2004; and Johnson, Edmonds, Moraes, Filho, & Tenenbaum, 2007) have addressed the *during* competition affect-performance linkage using measures of affect via a probabilistic theoretical methodology (Kamata, Tenenbaum, & Hanin, 2002). Implementing this methodology results in Individual Affect-related Performance Zones (IAPZs), which are defined in this study as that range of affective intensity within which an individual has the highest probability of performing at a specific performance level (e.g., poorly, moderately, or optimally). The ability of this methodology to identify greater than two performance categories (i.e., it avoids dichotomizing performances into just "in" or "out" of the zone) is an additional advantage of the IAPZ methodology over previous techniques.

The current study calculates the IAPZs for four intercollegiate tennis players and then discusses the role that momentum states may play in the implementation of a psychological skills training program. Based on prior research, it was anticipated that (a) each player would exhibit unique IAPZ probability curves (Hanin, 2000; Lazarus & Folkman, 1984); (b) the players' IAPZs would reflect some similarities (Yerkes & Dodson, 1908); (c) higher performing players would experience affective intensity within their optimal IAPZ more frequently than lower performing players (Ericsson, Krampe, & Tesch-Romer, 1993); and (d) higher level players would exhibit more stable affect, and by extension, more stable performances than lesser performers (Hanin, 2000; Schneider, 1993; Starkes, Deakin, Allard, Hodges, & Hayes, 1996).

Method

Participants

Four male varsity tennis players from an NCAA Division I university in the southeastern United States provided sufficient data to identify their IAPZs and allow further elaboration. These players were the number one, two, five, and eight ranked players on the team during one competitive intercollegiate tennis season, and are designated as Player A, B, C, and D, respectively, within this article. Player A was 22 years of age, in his third year on the university's team, had 12 years of competitive tennis experience, practiced 18 hr per week during the competitive season, and was ranked in the top 40 in the country by the Intercollegiate Tennis Association. Player B was age 18, in his second year on the team, had 10 years of competitive tennis experience, spent 20 hr each week in practice, and was ranked in the top 70 in the country. Players C and D were age 19 and 23, with 8 and 10 years of competitive tennis experience, respectively; each in their second year on the team, spent 15 hr per week practicing, and neither were ranked in the top 100 nationally. In addition, the Intercollegiate Tennis Association ranked the team in the high 30s.

Instrumentation

The Affect Grid. The affect grid (Russell, Weiss, & Mendelsohn, 1989) was used to record affect during competition. The grid is designed to allow for a quick assessment of affect along two dimensions: pleasure and arousal (see Figure 1).

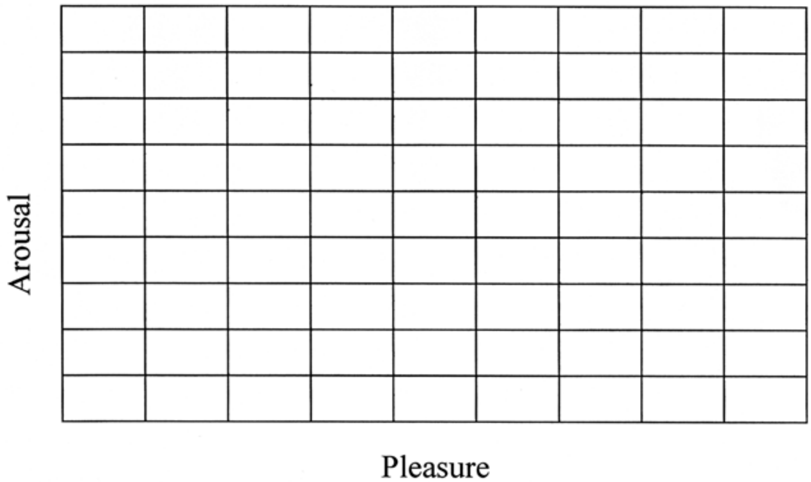

Figure 1—The affect grid: a circumplex model of affect.

This circumplex model of affect presents one's affective experience in a two-dimensional space defined by hedonic tone (i.e., pleasure) and activation (i.e., arousal) as described by Russell (2003). The affect grid overcomes a number of shortcomings of scales that measure emotions, as emotions are comprised of discrete categories that are often highly correlated and do not effectively address emotions or feelings that do not fall into an a priori category (Russell et al., 1989). Furthermore, the pleasure and arousal dimensions were found to be orthogonal to one another (Russell & Pratt, 1980), thereby improving the construct validity of the current study.

The affect grid consists of a set of 9 × 9 squares (see Figure 1). The players marked an "X" in the appropriate square during each changeover (i.e., after the first game of each set and after every two games from that point forward) and upon completion of their match. For an in-depth explanation of the scoring rules in competitive tennis, the reader is referred to an official rulebook on collegiate tennis. The pleasure score, which ranged from 1 (*very unpleasant*) to 9 (*highly pleasurable*), was the number of squares marked along the horizontal axis, counting from left to right. The arousal score also ranged from 1 (*sleepiness*) to 9 (*highly energized*), and was the number of the squares marked along the vertical axis, counting from bottom to top.

Ample empirical evidence supports the independence of perceived arousal and pleasure, and the use and validity of the affect grid (Plutchick, 1980; Russell et al., 1989; Watson & Tellegen, 1985). Construct and criterion validity were also supported in a study with 72 undergraduates involved in intramural through intercollegiate athletics (Raedeke, Stein, & Schmidt, 1993). The affect grid's arousal and pleasure continua were also found to be independent ($r = .11$), thereby supporting its construct validity.

Below this grid, there was an additional continuum that was added by the researchers to assess each athlete's subjective perception of his performance quality at each changeover. Each athlete placed an "X" along this 9-point Likert-type scale based upon a range of from 1 (*very poor*) to 9 (*excellent*). These items (i.e., the measures of arousal, pleasure, and performance) were combined into a discrete unit that is referred to throughout this article as the *affect grid*.

Procedure

These procedures first address the tennis players and their behaviors during this study and then briefly describe the processes used to analyze the resultant data.

Participants and the Affect Grid. The university's coaching staff was approached with the concept of this study as part of a working relationship between the researchers and the university's athletic department. This study's lead author was a sport psychology consultant/intern in the second year of his counseling psychology doctoral program. This internship involved working with the university's tennis team on a daily basis for a full school year. Supervision of this work was provided by the lead author's major professor at that time, who is an extensively published researcher and sport psychology consulting practitioner of over 20 years.

Once the team's coaching staff agreed with the purpose of this study and its applicability to the team's performance enhancement, all nine players on the team were asked to participate. Players read the participant information sheet and signed a consent form. The players then received verbal instructions regarding the nature and use of the affect grid. They used the affect grid during one practice each week under intra-squad tennis match play during a 6-week period in order to become familiar with using this measurement tool during competitions.

Competitive collegiate tennis involves a "best two-out-of-three sets" format. Participants were asked to mark the affect grid quickly and with minimal thought and disruption to their match. Players were also observed during matches to ensure that the affect grid was filled out at the appropriate time. Six affect grids were printed on a single page allowing each player to record his affect (i.e., arousal and pleasure) and performance level during an entire set of games on a single 8.5" × 11" piece of paper. The players were supplied with a notebook that contained three pages of affect grids (i.e., 18 total grids) for each match.

Due to competitive roster limitations (i.e., only six individuals compete in any one intercollegiate dual tennis match), an injury (i.e., one player suffered a season ending injury and missed a large portion of the competitive year), and attrition (e.g., one player did not fill out the affect grid during matches as he reported that he found it too distracting), only four players provided sufficient data to allow for adequate statistical analyses.

Determination of IAPZ Probability Curves and IAPZ Profile Charts. The data for each player was analyzed in the following manner: Changeovers with a subjective performance level reported as 1, 2, or 3 were recoded as poor performances. Performances reported as 4, 5, or 6 by the athletes were recoded as moderate, and performances reported as 7, 8, or 9 were recoded as optimal. This was done in order to acknowledge that an optimal performance for one player may be judged as moderate for another, and to allow for adequate discrimination among more than two levels of performance for each player. Theoretically, any number of performance levels could be used. Next, affective intensity during only the optimal performances (i.e., OP) for each player was isolated. The mean affective intensity for these optimal performances was then independently calculated for both arousal and pleasure. The third step in this analysis was done in order to be in line with the Inverted-U notion and proceeds as described here. Data points associated with moderate performances were now separated into two categories: (a) moderate performances with an affective intensity below the mean affective intensity found in optimal performances (i.e., moderate/below: Mo/B), and (b) moderate performances with an affective intensity above the mean affective intensity found in optimal performances (i.e., moderate/above: Mo/A). A similar procedure was attempted for performances recorded as poor. However, the four tennis players who provided adequate data for statistical analysis reported a total of 11 data points (out of the 1,473) as "poor performances with an affective intensity above the mean affective intensity for optimal performances." Therefore, only those poor performances with an affective intensity below that found during an optimal performance (i.e., PP) were able to be included in this study's results as the remaining poor performances did not result in significance as described in the following step. Fourth, a series of logistical ordinal regressions (LORs) were performed as described in Kamata et al.'s (2002) methodology, which resulted in the regression coefficients necessary to create IAPZ probability curves (see Figure 2 for an example of Player B's IAPZ curves for his affective dimension of arousal). Fifth, once the IAPZ probability

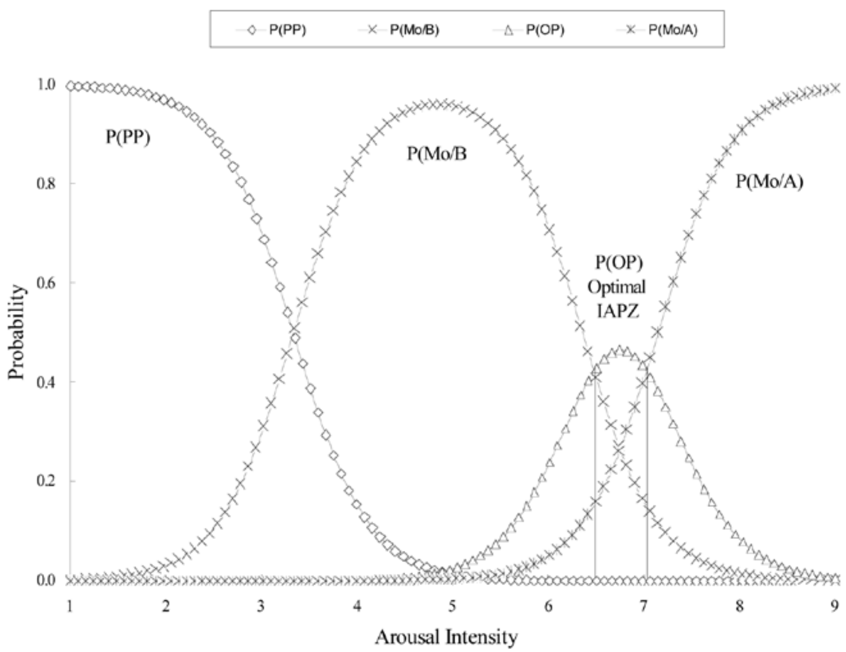

Figure 2—IAPZ probability curves for Player B derived from data for the affective dimension of arousal illustrating the probability of: (a) a poor performance - P(PP); (b) a moderate performance (given an affective intensity below the mean optimal arousal intensity) - P(Mo/B); (c) an optimal performance P(OP); and (d) a moderate performance (given an affective intensity above the mean optimal arousal intensity) - P(Mo/A); at each level of introspective affect intensity based on a 9-point Likert scale.

curves for all four players' arousal-performance and pleasure-performance linkages were established, IAPZ profile charts were created. Player B's IAPZ profile chart for arousal in Figure 3 provides an example of such a chart based on his IAPZ probability curve for arousal found in Figure 2. IAPZ profile charts take the range of affective intensity associated with each IAPZ probability curve (i.e., the *x*-axis on the IAPZ curves) and translate it onto the *y*-axis of the IAPZ profile chart. These charts facilitated the analysis of affective consistency and momentum states, which are described next.

Determining Affective Stability. At this stage of data analysis the original, introspective, during-competition reports from every match in the study (i.e., a total of 1,473 ordinal data points) were graphed onto the respective individual's IAPZ profiles. Figure 3 provides an example of each player's arousal intensity for a randomly selected single match during the study period. In order to perform the stability analyses described herein, IAPZ profiles were also created, however due to space constraints, they are not provided.

The frequency that a player was in a particular IAPZ for consecutive changeovers was used to describe his affective stability. Each match was analyzed for the number of times that player was in his particular IAPZ for consecutive changeovers.

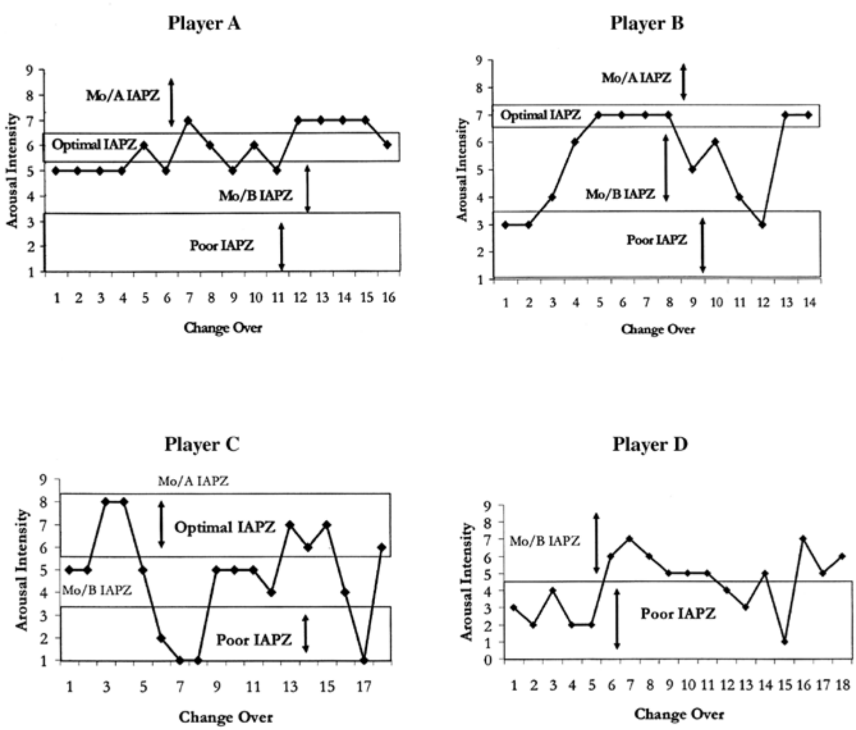

Figure 3—IAPZ profile charts for Players A, B, C, and D in their affective dimension of arousal, including data from a randomly selected competitive match during the season superimposed on each.

Affect intensity experienced within a single IAPZ during more than three consecutive changeovers was termed "very stable." Affect that occurred in a single IAPZ during three consecutive changeovers, two consecutive changeovers, and a single changeover was categorized as "stable," "somewhat stable," and "unstable," respectively. This method of description may provide salient data for further between- and within-individual analyses.

Results

Figure 2 provides an example of a randomly selected player's IAPZ curves on one affective dimension. For illustrative purposes, Player B's arousal IAPZ is supplied in this figure. IAPZ curves for all four players in both the arousal and pleasure dimensions are found in Figure 4. Note that in these IAPZ curves, the sum of probabilities (i.e., for each PP, Mo/B, OP, and Mo/A) at each discrete affective intensity level is 1.0. The IAPZ curves in Figure 2 illustrate the Inverted-U curve concept with an important addition. That is, when an athlete perceives low levels of arousal (e.g., from 1.0 to 3.0 in Figure 2) he or she has a greater probability of performing poorly than moderately or optimally. As this individual's introspective arousal level increases (e.g., from 3.0 to 4.8), his probability of a poor performance decreases, while the probability of a moderate performance increases. As the player's arousal intensity continues to increase so does his probability of an optimal performance, but only to a certain point (e.g., an arousal intensity of 6.75 for Player B). Beyond that idiosyncratic point, the probability of an optimal performance begins to decline until his arousal intensity reaches a point (e.g., 7.0 in Figure 2) at which a moderate performance becomes the most probable.

The results illustrated in Figure 4 reveal that each player's IAPZs showed similar patterns. Furthermore, the distribution among the players' four IAPZs was similar (i.e., predominantly moderate, $\chi^2\,(9, N = 4) = 12.00$, $p = .21$). However, closer inspection also illuminates unique aspects to each player's IAPZ curves. This provides an additional line of evidence that IAPZs are idiosyncratic and not generalizable among athletes, particularly since the nature of the ordinal data used in the current study was subjective and introspective. These data provide support for the possibility that individual athletes maintain idiosyncratic (a) perceptions of the environment and (b) coping and self-regulating strategies. Table 1 illustrates the IAPZs from Figure 4 in numerical form. Unique poor, moderate, and optimal IAPZs were uncovered for all four players on both arousal and pleasure dimensions. This includes Player D whose data did not support an optimal IAPZ for arousal, and Players B and C whose data did not support a moderate/above IAPZ for pleasure, as each of these players' introspective reports of pleasure resulted in optimal IAPZs that reached the ceiling of the scale used (i.e., 9.0 on the 9-point Likert scale).

However, commonalities among these four tennis players were also uncovered. Highlights of the similarities among these participants include: (a) poorest performances were found at lowest arousal levels; (b) optimal IAPZs tended to occur within introspective arousal intensities of 5.36 to 8.27; (c) Players A, B, and C recorded very similar ranges for their poor performances on the arousal dimension; and (d) on the pleasure dimension, all four players had minimal or non-existent Mo/A IAPZs.

Table 1 Intensity Ranges for Each Player for the Affective Dimensions of Arousal and Pleasure

Player		Poor IAPZ	Moderate/Below IAPZ	Optimal IAPZ	Moderate/Above IAPZ
	Arousal				
A	Min	1.00	3.10	5.36	6.33
	Max	3.10	5.36	6.33	9.00
	Range	2.10	2.26	0.97	2.67
B	Min	1.00	3.34	6.49	7.06
	Max	3.34	6.49	7.06	9.00
	Range	2.34	3.15	0.57	1.94
C	Min	1.00	3.34	5.44	8.27
	Max	3.34	5.44	8.27	9.00
	Range	2.34	2.10	2.83	0.73
D	Min	1.00	4.15	—	7.38
	Max	4.15	7.38	—	9.00
	Range	3.15	3.23	—	1.62
	Pleasure				
A	Min	1.00	1.73	7.06	8.92
	Max	1.73	7.06	8.92	9.00
	Range	0.73	5.33	1.86	0.08
B	Min	1.00	3.34	7.55	—
	Max	3.34	7.55	9.00	—
	Range	2.34	2.21	1.45	—
C	Min	1.00	1.89	5.93	—
	Max	1.89	5.93	9.00	—
	Range	0.89	4.04	3.07	—
D	Min	1.00	3.51	7.14	8.76
	Max	3.51	7.14	8.76	9.00
	Range	2.51	3.63	1.62	0.24

The widths of players' optimal IAPZs were also identified and compared. These comparisons are expressed via paired ratio-differences in percent value in Table 2. For example, Player A had an optimal arousal IAPZ that was 4.4% wider than Player B's and 20.7% narrower than Player C's. Table 2 also reveals that Player C had wider optimal IAPZs for both affective dimensions than any other player.

The results of each player's affective stability (i.e., patterns of movement among their various arousal and pleasure IAPZs) were also analyzed and these data are reflected in Table 3. Each changeover during the study period was analyzed relative to the changeover that preceded it and followed it in order to describe how frequently each player remained in, or shifted to, another IAPZ (e.g., from Mo/B

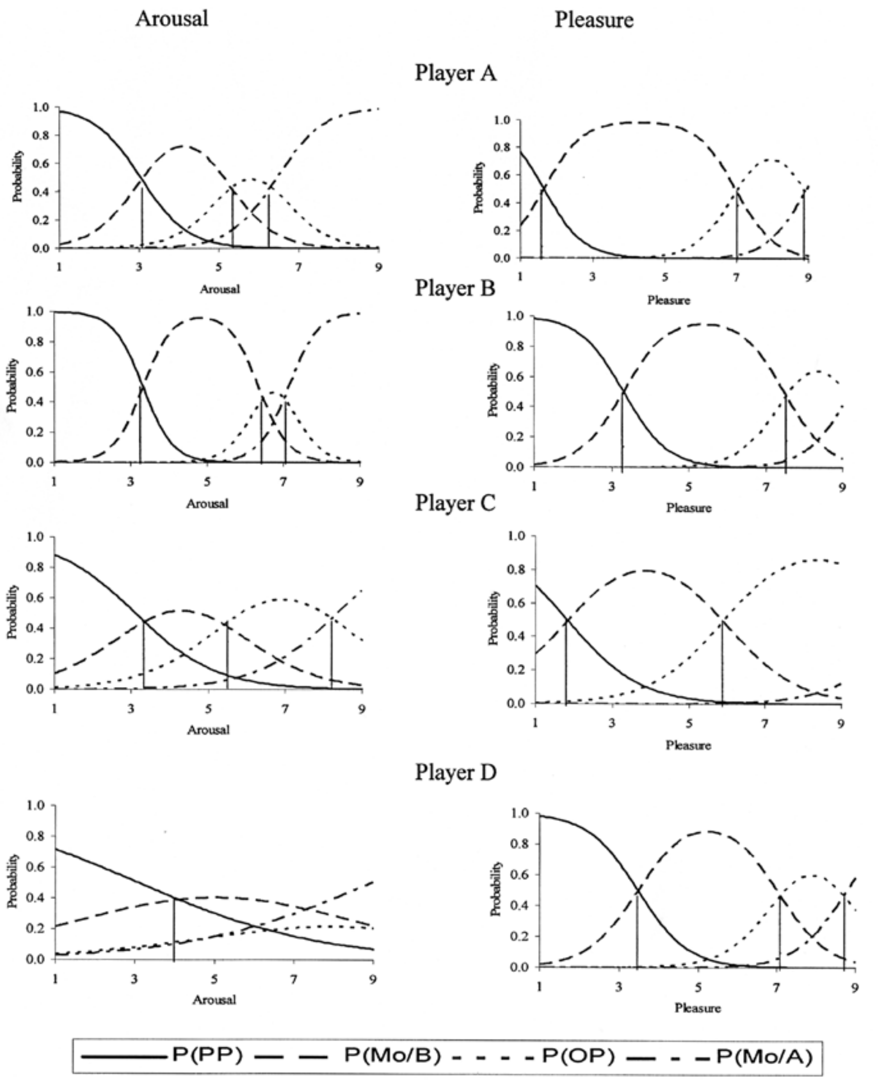

Figure 4—IAPZ probability curves for all four players in the affect dimensions of arousal and pleasure.

to OP). To illustrate this, Figure 3 shows each player's introspective, during-competition arousal intensities for one randomly selected tennis match, superimposed on his arousal IAPZ profile chart (note: an identical procedure was performed on each player's pleasure intensity). These charts elucidate the notion of momentum states as described by Bar-Eli and Tenenbaum (1989), whereby an athlete's affective intensity can oscillate among his or her idiosyncratic IAPZs during a single

Table 2 Percentage Differences Between Optimal IAPZ Widths by Player for the Affective Dimensions of Arousal and Pleasure

	Affective dimension	
Comparing player:	Arousal	Pleasure
A with B	4.4%	4.6%
A with C	–20.7%	–13.4%
A with D	—	2.7%
B with C	–25.1%	–18.0%
B with D	—	–1.9%
C with D	—	16.1%

competition. The sample IAPZ profile charts found in Figure 3, which illustrate momentum states as they relate to each player's affective stability, can now be used to evaluate each changeover relative to those it preceded and followed. Table 3 reveals the results of this analysis after compiling all data points from the arousal and pleasure dimensions for every tennis match used in the current study. The dominant condition encountered by every player was unstable, as each player moved from one IAPZ to another more often than he stayed in a single IAPZ for two, three, or more than three consecutive changeovers. For example, Player A experienced an unstable affective state in 54.7% of all of his changeovers. Furthermore, Player D was never in his optimal or moderate/above IAPZ for more than two consecutive changeovers. Therefore, Player D was considered to exhibit the least affective stability among the four players. Players B and C were the most affectively stable, as they had the greatest percentage of stable and very stable occurrences (i.e., 35.0% and 38.5%, respectively). In addition, Players A, B, C, and D were in their optimal IAPZs for 28.8%, 30.0%, 39.3%, and 11.9% of their changeovers, respectively. However, it may also be important to note the fact that Player C had substantially wider optimal IAPZs for both arousal and pleasure when compared to the other three players (while also noting that his performance level was significantly lower than that of Players A and B who participated in the study). Thus, the width of an athlete's optimal IAPZ and his or her subjective performance ratings may also need to be considered when evaluating the frequency that an athlete is in his or her optimal IAPZ, and therefore, what type of intervention to implement.

Discussion

The purposes of this study were to further verify the ability to operationalize a probabilistic approach (Kamata et al., 2002) to the affect-performance linkage, and propose ideas regarding how the resultant information could be used in an athletic setting. The current study linked four intercollegiate level tennis players' affective intensity states with their performance levels via Kamata et al.'s methodology. Unique IAPZs for each of the four players were identified through the use of the

Table 3 Frequency Values for Each Player's Affective Dimensions (i.e., arousal and pleasure) in Each of the Four Performance Zones Experienced by Athletes

	Occurrences								Totals	
Consecutive changeovers	Poor IAPZ		Mo/B IAPZ		Optimal IAPZ		Mod/A IAPZ		Count	%
Player A										
1	17	12.2%	16	11.5%	29	20.9%	14	10.1%	76	54.7%
2	1	0.7%	8	5.8%	5	3.6%	5	3.6%	19	13.7%
3	1	0.7%	14	10.1%	2	1.4%	1	0.7%	18	12.9%
> 3	1	0.7%	19	13.7%	4	2.9%	2	1.4%	26	18.7%
Total	20	14.4%	57	41.0%	40	28.8%	22	15.8%	139	100.0%
Player B										
1	12	8.6%	16	11.4%	22	15.7%	9	6.4%	59	42.1%
2	6	4.3%	14	10.0%	12	8.6%	0	0.0%	32	22.9%
3	4	2.9%	9	6.4%	3	2.1%	1	0.7%	17	12.1%
> 3	0	0.0%	27	19.3%	5	3.6%	0	0.0%	32	22.9%
Total	22	15.7%	66	47.1%	42	30.0%	10	7.1%	140	100.0%
Player C										
1	12	8.9%	27	20.0%	19	14.1%	0	0.0%	58	43.0%
2	5	3.7%	15	11.1%	4	3.0%	1	0.7%	25	18.5%
3	2	1.5%	4	3.0%	6	4.4%	0	0.0%	12	8.9%
> 3	3	2.2%	13	9.6%	24	17.8%	0	0.0%	40	29.6%
Total	22	16.3%	59	43.7%	53	39.3%	1	0.7%	135	100.0%
Player D										
1	24	20.3%	32	27.1%	13	11.0%	3	2.5%	72	61.0%
2	16	13.6%	16	13.6%	1	0.8%	0	0.0%	33	28.0%
3	4	3.4%	4	3.4%	0	0.0%	0	0.0%	8	6.8%
> 3	1	0.8%	4	3.4%	0	0.0%	0	0.0%	5	4.2%
Total	45	38.1%	56	47.5%	14	11.9%	3	2.5%	118	100.0%

affect grid (Russell et al., 1989), thereby culling within-competition, introspective reports of affective intensity, and their respective subjectively self-reported performance outcomes. As such, the current study adds support to the validity of the probabilistic methodology for determining zones of affect-performance quality.

Hypotheses 1 and 2

Visual inspection of the IAPZ probability curves in Figure 4 and the affective ranges in Table 1 illustrate that each player had unique IAPZs. This finding is congruent with Hanin's (2000) IZOF model, which includes the notion that the emotion-performance linkage is unique to each individual. The results found in this study were also consistent with the contention of previous studies (Annesi, 1998; Krane, 1993; Salminen, Liukkonen, Hanin, & Hyvonen, 1995; Woodman, Albinson, & Hardy, 1997) that used anxiety and other scales of discrete emotions prior to competition and uncovered a correlation between an individual's emotional states and his or her optimal functioning.

Given the support for the uniqueness of the players' IAPZs, this study's findings also provide support for the second hypothesis in that similarities among players existed, which is congruent with the Inverted-U hypothesis (Yerkes & Dodson, 1908). These tennis players' optimal IAPZs for arousal typically ranged between 5 and 7 on a 9-point Likert scale, whereas optimal IAPZs for pleasure frequently ranged from between 7 and 9. Poor and moderate performances were frequently marked by low or extremely high arousal, and low to moderately high levels of pleasure (i.e., poor and moderate/below pleasure IAPZs ranged from 1.0 to between 5.93 and 7.55 on the 9-point Likert scale).

The IAPZ conceptualization avers that the subjective interpretation of an individual's affective experience is a reflection of the coping resources and motivational energy one has and uses to manage the competitive demands of the moment. This is harmonious with contentions proffered by Edmonds et al. (under review) and Russell (2003), which assert that an individual's states of core affect influence his or her reflexes, perceptions, cognitions, and behaviors. It is feasible that the high levels of pleasure associated with optimal tennis performance are necessary, as they may be indicators of positive energy and flow (Apter, 2001; Golden, Tenenbaum, & Kamata, 2004; Jackson & Csikszentmihalyi, 1999; Kerr, 1997). Therefore, based on these empirical works and the data from the current study, even though an individual's optimal zones are unique, tennis players may benefit from interventions that facilitate reaching high levels of introspective pleasure, while also being aware of the idiosyncratic nature of the affect-performance relationship, and the potentially salient role played by momentum states.

Hypotheses 3 and 4

In an environment of shifting momentum, such as intercollegiate tennis, it was anticipated that higher-level athletes would be more able to draw upon superior coping skills and self-regulating mechanisms to stabilize their affective intensity in a manner that improves their chances of an optimal performance. Both theory and research support the notion that higher level athletes, defined as those who perform better more frequently (Ericsson, 1998; Ericsson & Kintsch, 1995; Ericsson et al., 1993; Helsen, Starkes, & Hodges, 1998; Hodges & Starkes, 1996), exhibit greater affective stability (Hanin, 2000; Schneider, 1993; Starkes et al., 1996). This infers that higher performing athletes would be in their optimal IAPZ more consistently than lower level athletes, particularly when experiencing the shifting momentum states often found within a single competition (Kerick, Iso-Ahola, & Hatfield, 2000). However, results from Players A, B, and C show that a lower-level player

(Player C) had a wider optimal IAPZ for both arousal and pleasure. This appears to contribute to Player C's greater frequency in his optimal IAPZ. Therefore, support for the contention that higher-level athletes would be in their optimal IAPZ more often and consistently, was not found in the current study. However, the idiosyncratic nature of the introspective measurement tool used in this study may play a role in the inter-player comparisons presented herein. It is possible that Player C possesses less focused affect and lower self-awareness that results in his being in the optimal IAPZ more often and consistently than two superior players. Increasing an athlete's affective self-awareness may be an important initial step in determining if it is in the athlete's best interest to increase or decrease his or her arousal or pleasure levels. This is congruent with the idiosyncratic nature of the IAPZ conceptualization. In addition, being able to identify the degree to which an individual is deviating from his or her optimal IAPZ may impact the selection of a particular sport psychology intervention technique or strategy. Sport psychology interventions that emphasize increasing one's affective awareness (e.g., via goal setting, journal writing, or identifying current self-talk tendencies) may be beneficial, particularly for athletes with relatively wider optimal IAPZs. And finally, improvements in technology may provide future opportunities to implement a methodology that uses objective measures of individuals' affective states (e.g., biofeedback), thereby improving upon the measurement tool used in the current study.

Stronger support for the final two expectations of this study may have been found if it was possible to integrate the widths of the players' IAPZs when determining the stability and frequency of the athletes' affective states throughout matches. Thus, future research will likely benefit from taking into account the width of players' IAPZs when considering players' affective stability and frequency throughout a match.

Sport psychology skills training and strategies designed to increase an individual's self-awareness may also lead to an improved ability to introspectively discriminate among optimal, moderate, and poor performances, all of which were used as variables in the current study. However, it may be important to recognize that a higher-level player's perceived moderate performance rating could be considered an excellent performance to a lower-level performer. Therefore, perceived performance ratings cannot be confused with, or interpreted in, absolute terms. Future research investigating the affect-performance relationship may also benefit from selecting a competitive domain that consists of objective performance criteria.

Support for the efficacy of the current study's methodology was also supported by the fact that all four players reported a greater number of moderate performances than either optimal or poor performances. Previous research investigating various emotion-performance linkages for in- and out-of-the-zone approximations (see Jokela & Hanin, 1999; Robazza, Pellizzari, & Hanin, 2004) do not include the moderate performance zone. As life is often experienced in shades of gray rather than in dichotomous black-and-white terms, there appears to be some utility in a methodology that allows for the description of a continuum of experiences to be analyzed. Future studies should consider investigating an individual's coping strategies that elicit a shift from an affective intensity associated with a moderate or poor IAPZ to an affective intensity associated with an optimal IAPZ. In addition, the Kamata et al. (2002) procedure brings to light another potential benefit provided by this probabilistic methodology. That is, identifying probabilities of performance quality allow the athlete to self-regulate in a general direction if he or she is having difficulty implementing a specific affective intensity. For example, if an athlete has identified that a high level of pleasure is linked with a greater chance of performing moderately well with little risk of performing poorly, as was shown for the tennis players in the current study, then the individual can at least engage a coping strategy or skill that he or she has confidence will simply raise his or her introspective level of pleasure.

It may also be important to emphasize the individual psychological differences a player brings with him or her when implementing an affect-related performance program. Future research should consider investigating any moderating influences that dispositional psychological factors may have. To date, there is little empirical support that specific psychological traits are related to discrete performance levels. However, factors such as culture and psychological traits have been suggested to play a significant role in the efficacy of psychological interventions (Boyd-Franklin, 1989; Paniagua, 1994). In addition, care must be given to consider any clinical or sub-clinical issues of significance presented by the athlete and possible interpretations of that (e.g., "diagnostic overshadowing"; Spengler, 2000). Finally, as it is possible that language and verbal expression (Russell, 2003) may impact subjective reports of affect, future research should consider using objective measures of affect (e.g., heart rate, respiration) in an effort to further strengthen the understanding of the affect-performance relationship.

A salient factor in the applicability of any potentially effective performance enhancement intervention is the soundness of the methodology undergirding that intervention. As one of this study's foci was to test a sound structural foundation for the applied use of the probabilistic affect-performance methodology (Kamata et al., 2002), no interventions were performed as part of this study. Future research that can measure baseline IAPZs, then implement an appropriate sport psychology training program, and finally measure post-intervention IAPZs with appropriate statistical control will improve upon the understanding of the cause-and-effect relationship between an individual's affective intensity and his or her performance quality.

Conclusion

This study illuminates and expands the understanding of how a theoretical and probabilistic methodology (Kamata et al., 2002) can be implemented during competition and used to facilitate the implementation of an idiosyncratic performance enhancement program. Athletes, coaches, and sport psychology consultants may benefit tremendously from an improved understanding of an athlete's affective intensity as a dynamic variable during competition, and its potential to impact performance both positively and negatively. Knowledge of an athlete's IAPZs and his or her affective awareness and psychological tendencies may very well positively influence the implementation of an intervention program designed to improve that individual's performance level and improve his or her consistency at that level. These coping strategies and self-regulation techniques can then be monitored for their effectiveness, permitting constructive feedback to the athlete, coach, and sport psychology consultant.

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