Objectivity and reliability of judging filmed routines in women's gymnastics

Pamela Marie Burgess

The University of Montana

1971

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THE OBJECTIVITY AND RELIABILITY OF JUDGING
FILMED ROUTINES IN WOMEN'S GYMNASTICS

By
Pamela M. Burgess
B.S., University of Montana, 1970

Presented in partial fulfillment of the requirements for the degree of
Master of Science
UNIVERSITY OF MONTANA
1971

Approved by:

Chairman, Board of Examiners

Dean, Graduate School

Date
Sept. 1, 1971
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CHAPTER I

INTRODUCTION

The judging of gymnastics is one of the most difficult officiating tasks in the world of sports (12). Judges may be called upon to evaluate both optional and compulsory routines. Judging compulsory exercises is less difficult than judging optional routines (12). The judge knows what the gymnast will attempt to do. The evaluation of the exercise is made in terms of how well the gymnast complies with the requirements of that exercise. A judge has the opportunity to study the routines long before she is required to judge them. In optional exercises, the judge does not know what the performer will do. She must recognize difficulty elements, and evaluate composition and originality of each as stipulated in the Federation of International Gymnastics (F.I.G.) Code of Points.

The compulsory exercises are evaluated on a continuum from 0.0 to 10.0 points by tenths of a point with 10.0 representing a perfect performance. The breakdown of the 10.0 points is as follows (5).
<table>
<thead>
<tr>
<th>Evaluation Factor</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exactness and precision of all parts</td>
<td>2.0</td>
</tr>
<tr>
<td>Exactness and precision of direction and floor pattern</td>
<td>0.5</td>
</tr>
<tr>
<td>Precision of rhythm</td>
<td>1.5</td>
</tr>
<tr>
<td>Elegance of gymnast</td>
<td>1.0</td>
</tr>
<tr>
<td>Sureness of the execution</td>
<td>1.5</td>
</tr>
<tr>
<td>Amplitude of movements</td>
<td>1.5</td>
</tr>
<tr>
<td>Coordination of movements</td>
<td>1.0</td>
</tr>
<tr>
<td>Lightness of jumps and acrobatics</td>
<td>1.0</td>
</tr>
<tr>
<td></td>
<td>10.0</td>
</tr>
</tbody>
</table>

When judging a compulsory exercise the judge will receive in advance the "code of deductions" for all exercises. The "code of deductions" will describe all parts of the exercise listing all the various deductions that will apply to each part. When evaluating a compulsory exercise, it is imperative that the judge has memorized the compulsory routine exactly as printed in the text (9).

Each optional exercise is worth a maximum of 10.0 points if performed perfectly. The six evaluation factors are as follows. The points awarded under each evaluation factor cannot exceed the limit shown (5).

<table>
<thead>
<tr>
<th>Evaluation Factor</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Form and Execution</td>
<td>1.5</td>
</tr>
<tr>
<td>Difficulty</td>
<td>4.0</td>
</tr>
<tr>
<td>Amplitude</td>
<td>1.5</td>
</tr>
<tr>
<td>Originality and Combinations</td>
<td>1.5</td>
</tr>
<tr>
<td>General Impression</td>
<td>1.0</td>
</tr>
<tr>
<td>Composition</td>
<td>0.5</td>
</tr>
<tr>
<td></td>
<td>10.0</td>
</tr>
</tbody>
</table>
1.5 FORM AND EXECUTION--Under this phase of the exercise, the judge must notice if the movements are mechanically correct... execution (9).

4.0 DIFFICULTY--The judge must know the difficulty ratings well. She must know if the difficulties used are of the higher values or the lower values, since this can affect the combinations mark or the composition mark (9).

1.5 AMPLITUDE--Amplitude is usually referred to as "the bigness of the movement" or "extending to the fullest." However if a skill is mechanically correct, amplitude will be there (9).

1.5 ORIGINALITY AND COMBINATIONS--0.5 points is reserved for originality and 1.0 point for combinations, level of difficulties, risk and courage. A judge must recognize the risk and courage of a single element as well as the risk and courage in the combinations of skills and connections.

1.0 GENERAL IMPRESSION--The exercise is evaluated as a whole for general impression, general beauty, lightness of performance, rhythm throughout and the way the entire exercise was presented. The harmony of movements and music, the harmony of the gymnast and the apparatus should be considered, also confidence, sureness, vitality, elegance and gracefulness (9).

0.5 COMPOSITION--In evaluating the composition of an exercise, a judge must observe the mount and dismount, which cannot be identical
to that used in the compulsory exercise. Also, the mount and dismount should correspond to the difficulty of the exercise. The entire exercise must have a technical value balanced and progressive in density adapted to the technical possibilities and morphology of the gymnast (9).

The following points illustrate some of the judges duties:

1. He must know the point values of all the individual moves involved in the competitor's routine.
2. He must place a potential value on the difficulty of the completed routine.
4. He must differentiate between major and minor form breaks and deduct accordingly.
5. He must place a value on the execution of each stunt and the total routine (11).

If excellence in gymnastic judging is to be obtained an official must know and be able to meet the above requirements.

Research in gymnastic judging performance reveals four different commonly used approaches. In an example of the first approach, Hunsicker and Loken (18) examined the effect of averaging all the judges' scores rather than averaging the middle scores. They concluded that definite changes in individual standings resulted when
the scores of all five judges were used.

A second approach used to study gymnastic judging is based on the assumption that the greater the range of scores for a particular performer, the poorer the quality of judging. Using the average difference between high and low scores (4) as a measure of judging performance, investigators have concluded that a small rather than a large difference between judges' scores indicates more objective judging.

The third approach involves judges rating filmed performances to better determine the judges' scoring reliability and accuracy (20). In addition, this approach has been suggested to control for many extraneous, and sometimes confounding factors present in the meet situation (e.g., judges' viewing perspective, audience pressures, and judges changing scores after conferences) (20).

A fourth approach used in studying gymnastic judging involves analysis of the degree of agreement between the judges (20). Investigators using this technique have generally found most reliability coefficients to be high and significant, indicating that the judges were applying similar standards.

Sterling and Webb (25) suggested that for increased objectivity the judges should not show their scores to each other during the competition. They maintain that under the present open scoring system "the showing of scores after each performance serves as a feedback mechanism which reduces the objectivity of scoring (25)."
"Gymnastic coaches have noted problems in the present scoring system and have made various proposals which hopefully would make judging more accurate, reliable, and objective. As in most endeavors, however, research has not kept up with the existent problems in the field (20)." The methodological approach recommended to investigate problems of judges' accuracy is the use of filmed performances in a controlled situation (20).

The D. G. W. S. practical national rating test is based on filmed performances for both optional and compulsory routines. Only certified boards and approved United States Gymnastic Federation (U. S. G. F.) members may rent the rating film for a three-day period. The script-workbook, The Training of Judges for Girls Gymnastics, has been revised in accordance with the new F. I. G. Code of Points and used in conjunction with the revised training film to train judges for optionals. Both the training and rating films are 16mm black and white films (8).

For most judges, the first opportunity to judge a routine on film is during the national rating test. To arrive at the most objective score possible in using films for judging, a judge would have the opportunity to view the film several times. However, at the national rating test the judges are able to view the routines once and are then expected to arrive at a score from the one viewing.

In no other women's sport are the officials required to view filmed performances for the practical portion of a national rating test.
Viewing of filmed performances in gymnastic judging research can be justified because it allows for the testing of judges' scoring reliability and agreement and also for the testing of hypotheses under controlled conditions. However, an official who has always judged in a meet situation may experience difficulty in rating a filmed performance, especially if it is the first routine judged on film. The reliability, accuracy and objectivity of the filmed rated scores can then be questioned.

No one knows for certain whether reliable gymnastic scores can be obtained from a video-taped viewing (16). Some factors to be determined are: significant differences between scores awarded live performances and scores awarded video-taped routines, the effect of camera angle (judging angle) on scores awarded, and the similarity of scores awarded for a routine viewed live and on video tape by the same judge (16).

THE PROBLEM

The purpose of this investigation was to determine the reliability and objectivity of judging filmed performances as compared to judging live routines. The sub-problems were as follows:

1. to test the relationship of scores awarded a live performance and those awarded a video-taped performance.
2. to see if inexperienced judges perform as consistently as experienced judges when rating filmed performances.
Significance of the Problem

For most gymnastic judges, the first opportunity to judge filmed routines is during the national rating test. These routines are viewed once and the judge is expected to arrive at a score within one minute. An official who has always judged in a meet situation may experience difficulty in rating a filmed performance. To prepare judges for the national rating test, an opportunity to judge filmed routines should be available so the judge can become familiar with taped routines before having to judge them. Filmed routines are used in research to control extraneous and sometimes confounding factors present in the meet situation, such as judges' viewing perspective, audience pressures and judges changing scores after a conference (20). Judges who have taken the national rating practical test have commented that rating filmed performances is quite different than judging in a meet performance and expressed a desire for more experience in the judging of filmed routines before taking another national test.

Limitations

Due to the number of women's gymnastic judges available in Montana, the study was limited to five judges. The sample included both novice and experienced judges. The novice judges received training in a gymnastic judging class offered at the University of Montana. The experienced judges have judged college meets for at least two years.
Definitions

For the purpose of clarification and understanding, the following terms and their definitions were used in this study:

1. **Reliability**--the extent to which a repeated measurement produces the same result (14). The extent to which the same judge is consistent in applying the same criteria to every routine.

2. **Validity**--the extent to which the measurement deals with the level of quality it is supposed to deal with (14). The extent to which the F. I. G. Code of Points, U. S. G. F. rules, and D. G. W. S. rules are applied to each routine.

3. **Objectivity**--without bias or prejudice (14).

4. **D. G. W. S.**--Division of Girls' and Women's Sports (9).


6. **Olympic Events**--floor exercise, uneven parallel bars, balance beam, and vaulting (9).

7. **Compulsory Routines**--gymnastic routines prepared by a joint committee from the D. G. W. S. and the United States Gymnastic Federation (9).

8. **Optional Routines**--routines made up by the gymnast (9).
CHAPTER II

REVIEW OF RELATED LITERATURE

Since the beginning of competitive gymnastics, coaches and competitors have expressed concern regarding the objectivity of gymnastic judging (20). In gymnastics, as well as in other sports involving artistic elements, the use of human observers (judges) to determine performance scores cannot be avoided (20). It is therefore surprising that a sport which relies so heavily on human observers to determine the outcome of competition does not have more research concerning factors which may influence the accuracy of judges' scores. The following review presents the studies involving procedures for objectifying gymnastic judging and research investigating gymnastic judging performance.

SUGGESTED PROCEDURES FOR OBJECTIFYING JUDGING

Ryser (24), Wilson (27), and Beyer (3) have proposed the use of scoring systems similar to those used in tennis, golf and wrestling for gymnastic dual meets. Under these methods a gymnast in each event would be paired against an opponent and the winner of two-man contests determined. It is suggested (24, 27) that this method would
help eliminate subjectivity since the judges would be deciding between two routines instead of five or six.

Other proposals are based on the assumption that judging only one part of an exercise (difficulty, execution, or composition) increases the judge's accuracy and reliability (20). Bauer (2), Nooney and Warrick (22), and Welser (26) have proposed a specialized system supporting the idea of one judge being responsible for only one area. Under this system the three scores are added together to give the final score. Along with the division of responsibility for each judge, it has been further recommended that the use of more judges (two or more) for each area might improve objectivity and make it possible to have two execution judges at different angles to the performer (22).

RESEARCH ON GYMNASTIC JUDGING PERFORMANCE

Research in gymnastic judging performance is typified in four different commonly used approaches. In the first, Hunsicker and Loken (18) examined the effect of averaging all the judges scores (four scores) rather than averaging the two middle scores. The scores from the National Collegiate Athletic Association Gymnastic Meet held at the United States Military Academy in 1950 were used. The intercorrelations of the five judges' scores were determined for all six events. One correlation was below 0.80 and fifty relationships were 0.85 or higher. It was shown that if the scores of all five judges were
used in determining results, definite changes in individual standings resulted. The major advantage of the net score, especially for inexperienced judges or difficult to judge routines, is that it prevents an extreme score from unduly influencing the mean performance score (20).

A second approach used to study gymnastic judging is based on the assumption that the greater the range of scores for a particular performer the poorer the quality of judging. Using the average difference from the judging panel's mean score (4) or the average difference between high and low scores (17) as measures of judging performance, investigators have concluded that a small rather than a large difference between judges' scores indicates more objective judging. Calkin (4) designed a computer program which affords a more objective look at a judge's performance in a meet situation. The scores of each judge and the meet score are punched on IBM cards for each contestant in each event of the meet. The program output first gives the number of times each judge's score was discarded because it was high score. Then the number of times each judge's score was discarded as low score is recorded. The program gives the mean of all the scores given by each judge. This shows at a glance which judges on the panel were generally high and which were generally low in their scoring. An intercorrelation matrix is then printed out. This gives the correlation of each judge's scoring with the meet score and with each of the other judges (4).

A third approach used in gymnastics judging research involves
the degree of agreement between the judges (20). Investigators using this technique have generally found most coefficients to be high and significant, indicating that the judges were applying similar standards. Faulkner and Newt (10) used the scores of the NCAA Gymnastic Meet held at the University of Illinois in 1961 in a statistical analysis. Each of the four judge's scores, the average of the middle two judges' scores (net score), and the average of the four judges' scores were intercorrelated. Twenty-six of the one hundred and twenty correlations were below .76 (.01 level of significance).

The fourth approach involves judges rating filmed performances to better determine the judges' scoring reliability and accuracy (20). This approach has been suggested to control many extraneous, and sometimes confounding factors present in the meet situation, such as judges' viewing perspective, audience pressure, and changing of scores after conference (20). By using judges' rating of filmed performances rather than post-meet results, hypotheses can be tested under controlled conditions. Landers (20) examined the effect of judges rating filmed routines utilizing two methods of judging. Twelve F.I.G. judges representing the Northern California Gymnastic Officials Association and twelve Bauer method judges, who were selected to judge the 1965 Big Ten Gymnastic Championships, judged twenty-three Olympic event routines of various performance levels. The twelve Bauer method judges' scores (one difficulty, one composition, and one
execution judge's scores) were randomly combined in order to compare these "nominal" total scores with the total scores of the F.I.G. individual judges. The results showed that the Bauer judges who rated only one category had significantly less variance ($p < .01$) from absolute ratings, less intravariance ($p < .01$) about their own mean, and higher reliability (.853) than the F.I.G. judges (.619) (19).

THE USE OF FILMED ROUTINES
IN GYMNASTIC JUDGING

In order to avoid many of the pitfalls inherent in the actual meet situation the research strategy recommended for these problems, as well as certain social-psychological problems, is that of using filmed routines in a controlled situation (20). With the use of filmed routines, judges' reliability can be evaluated. Film analysis can be used to determine more objective, "absolute" scores against which the judges' scores can be compared (20).

Not only could the questions raised by gymnastic coaches be investigated with the use of filmed routines, but many social-psychological influences inherent in many meet situations could be investigated in order to determine their degree of influence on the judges' scores. The following social-psychological influences merit research consideration in gymnastics: (a) judges' expectations of the performer's ability; (b) the judges' resistance to conformity pressures; (c) the judges'
institutional or national-political affiliation; and (d) the judges' attitudes and beliefs concerning certain personal characteristics of the performer (20).

Gymnastic coaches have noted problems in the present scoring system and have made various proposals which hopefully would make judging more reliable and objective. They include dividing the judges' responsibility so one is judging difficulty, one composition and one execution; deciding winners in two-man contests; and alternating rating scores for different performance levels (17).

The methodological approach recommended to investigate problems of judges' accuracy is the initial use of filmed performances in a controlled situation. Semi-controlled studies in the actual meet situation are then recommended through the use of filmed performances to test those factors which have been demonstrated to significantly influence judges' accuracy. In this way modifications and improvements of the present F. I. G. Code of Points and judging procedure may result which would improve the "human yardsticks" so necessary in competitive gymnastics (20).
CHAPTER III

PROCEDURE

THE SUBJECTS

Five judges were selected to participate in the study conducted during Winter Quarter 1971 at the University of Montana. Two of the judges were novice judges. The remaining three had at least two year's experience in judging Montana college level meets involving D. G. W. S. compulsory routines. Judge one has a D. G. W. S. Regional Rating. Three of the judges, judges two, three, and five, have completed a course in judging gymnastics at the University of Montana and all five of the judges have taken the written examination to qualify them to judge college level meets in Montana. See Table I for the judges' qualifications.

TEST PROCEDURE

The judging of the routines was done the first week of January 1971 at the Women's Center Gymnasium, University of Montana. One of the instructors in the Women's Physical Education Department, who has had experience filming with the video tape, operated the video tape machine. Table II shows the position of the camera for each piece of equipment.
<table>
<thead>
<tr>
<th>Judge</th>
<th>Rating</th>
<th>Judging Test</th>
<th>Class in Gymnastic Judging</th>
<th>Years of Judging Experience</th>
<th>Experience in Gymnastics</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Regional</td>
<td>National</td>
<td>Three +</td>
<td>Instructor &amp; Coach</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rating Test</td>
<td>Rating Test</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>National</td>
<td>Test</td>
<td>Two</td>
<td>Instructor &amp; Asst. Coach</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rating Test</td>
<td>Test</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>III</td>
<td>National</td>
<td>Test</td>
<td>One</td>
<td>Maj. &amp; Min. Gymnastic Class</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rating Test</td>
<td>Test</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IV</td>
<td>Montana</td>
<td>Judging Test</td>
<td>One Season</td>
<td>Gymnast Three Years</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Judging Test</td>
<td>Test</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V</td>
<td>Montana</td>
<td>Test</td>
<td>One Season</td>
<td>Gymnast One Year</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Judging Test</td>
<td>Test</td>
<td></td>
<td></td>
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</tbody>
</table>
TABLE II
CAMERA POSITION

<table>
<thead>
<tr>
<th>FLOOR EXERCISE</th>
<th>Judges Position</th>
<th>Camera Angle</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Diagram" /></td>
<td><img src="image2" alt="Diagram" /></td>
<td><img src="image3" alt="Diagram" /></td>
</tr>
</tbody>
</table>
A Sony video-tape system on loan from the Instructional Materials Center at the University of Montana was used. A one-half inch Scotch video-tape was used for recording. A twenty-four inch model television was used to play back the routines.

The D. G. W. S. high intermediate compulsory routines for the four Olympic events were used. The D. G. W. S. high intermediate compulsory routines are included in Appendix B. Five members of the University of Montana Women's Varsity Gymnastic Team and five members of Missoula Sentinel High School's Gymnastic Team performed the routines. Five routines in each area of performance were judged. The judges were given one minute following the end of each routine to compute a score. No judges' conferences were held and no comparisons of scores were made among the judges.

The routines were video-taped as they were executed, at an angle that afforded the best view of the gymnast's movement. Eight days later the same panel of judges rated the video-taped routines. No judges' conferences were held and no comparisons of scores were made among the judges. The same procedure used during the live performance was followed with the video tape. The judges were given one minute to compute a score at the finish of a routine.

After the final routine, score sheets were collected and filed until the judges had evaluated the routines on the video tape eight days later. The judges did not see their live performance scores before
judging the video-taped routines.

There was no audience during either the gymnast's performance or the viewing of the video-taped routines.

TREATMENT OF DATA

The relationship between the live scores and the video-taped scores was analyzed with a Pearson product moment correlation coefficient. Significance of the Pearson $r$ was also determined. All of the judges' scores were compared to the D. G. W. S. Regional Rated Judge number one using the Pearson $r$ to determine objectivity. A t-test was used to compare the difference between the means for each judge's live and video-taped scores. The formulas for the statistical analyses appear in Appendix A.
CHAPTER IV

RESULTS AND DISCUSSION

In this study a simulated meet situation was staged to determine the relationship between gymnastic judges' scores obtained from live performances and those awarded video-taped routines. Each judge was instructed to evaluate the routines as they would at a gymnastic meet.

RELIABILITY

The scores for both the live performance and the video-taped routines appear in Table III. The more experienced judges (Judges one and two) were shown to have a higher correlation between the two sets of scores than the judges with less experience. Judge two had a correlation of .88 and Judge one a correlation of .77, both of which are significant at the .001 level. Judge four had a correlation of .56, which is significant at the .01 level and Judges three and five had correlations of .52 and .53, both of which are significant at the .02 level.

Landers (20) examined the effect of judges rating filmed routines utilizing two methods of judging. The results showed that the Bauer judges who rated only one category (difficulty, composition, or
### TABLE III

**COMPARISON OF LIVE ROUTINES AND VIDEO-TAPED ROUTINES**

<table>
<thead>
<tr>
<th>JUDGE</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
<th>V</th>
</tr>
</thead>
<tbody>
<tr>
<td>L V-T</td>
<td>L V-T</td>
<td>L V-T</td>
<td>L V-T</td>
<td>L V-T</td>
<td>L V-T</td>
</tr>
<tr>
<td>3.7</td>
<td>3.3</td>
<td>3.4</td>
<td>2.5</td>
<td>2.8</td>
<td>2.9</td>
</tr>
<tr>
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<td>3.0</td>
<td>4.6</td>
<td>3.7</td>
<td>4.0</td>
<td>4.3</td>
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<tr>
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<td>3.8</td>
<td>4.5</td>
<td>4.5</td>
<td>3.3</td>
<td>3.9</td>
</tr>
<tr>
<td>3.7</td>
<td>3.4</td>
<td>3.2</td>
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**Pearson r**

| 0.77 | 0.88 | 0.52 | 0.56 | 0.53 |

**Significance**

| 0.001 | 0.001 | 0.02 | 0.01 | 0.02 |
execution) had significantly less variance ($p < .01$) from absolute ratings, less intervariance ($p < .01$) about their own mean, and higher reliability (.853) than the F.I.G. judges (.619), who judged the entire routine.

The F.I.G. method of judging was used in this study and the correlations between the live and video-taped routines for the experienced judges were found to be significant at the .001 level. Judge three, whose correlation was significant at the .02 level, has had experience in judging but was not actively involved in judging during the competitive season in which this study was conducted. Judges four and five were beginning judges, but have previously judged the D.G.W.S. high intermediate compulsory routines used in this study.

T-tests were calculated to test the significance of the difference between the means of the live and video-taped scores for each judge. The novice judges showed no differences between the means of the video-taped scores and live scores. Significant differences (.01 level) were found for judges one and two with $t = 3.54$ and $t = 3.10$ respectively. The experienced judges seemed to apply the same criteria uniformly throughout the judging, but lower point values were awarded the video-taped routines.

The novice judges (four and five) expressed a difficulty in judging the video-taped routines due to the two dimensional viewing. The lack of continuity between their live and video-taped scores seems to relate to this difficulty. Judges one and two consistently judged the
TABLE IV

$t$ TEST AND LEVEL OF CONFIDENCE FOR DIFFERENCES BETWEEN THE MEANS OF THE LIVE AND VIDEO-TAPED SCORES

<table>
<thead>
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<th>JUDGES</th>
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<th>II</th>
<th>III</th>
<th>IV</th>
<th>V</th>
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<tr>
<td>$\bar{X}_D$</td>
<td>.55</td>
<td>.33</td>
<td>-.70</td>
<td>-.06</td>
<td>.08</td>
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<tr>
<td>$t$</td>
<td>3.54</td>
<td>3.10</td>
<td>7.05</td>
<td>.21</td>
<td>.39</td>
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TABLE V

CORRELATION OF JUDGES' LIVE PERFORMANCE SCORES WITH REGIONAL RATED JUDGE

<table>
<thead>
<tr>
<th>JUDGES</th>
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<th>III</th>
<th>IV</th>
<th>V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearson $r$</td>
<td>.77</td>
<td>.69</td>
<td>.43</td>
<td>.63</td>
</tr>
<tr>
<td>Significance</td>
<td>.001</td>
<td>.001</td>
<td>.10</td>
<td>.01</td>
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video-taped routines lower than the live performances. Judge three consistently judged the video-taped routines higher than the live performances. Judges one and two viewed all the live performances from the same angle, which was just the opposite from judge three. This difference in judging angle may have something to do with the higher scores judge three awarded the video-taped routines, as all the judges obviously viewed the video-taped routines from the same perspective.

OBJECTIVITY WITH LIVE SCORES

The judges with more experience had significantly higher correlations (.001 level as compared to the .01 and .10 level) than the judges with less experience when each judge's scores were correlated with the scores of regionally rated judge number one. Judge number two had the highest correlation of \( r = .77 \) which is significant at the .001 level. Judge three yielded a correlation of .69, significant at the .001 level. Judge number four, the judge with the least experience, had the lowest correlation \( r = .43 \) which is not significant.

Faukner and Newt (10) used the scores of the NCAA Gymnastic Meet held at the University of Illinois in 1961 in a statistical analysis. Each of the four judge's scores, the average of the middle two judges' scores, and the average of the four judges' scores were intercorrelated. They found twenty-six of the one hundred and twenty correlations were below .76 (.01 level of significance).
In this study all of the scores were not intercorrelated as the panel of judges used were not all experienced judges. But the judges with more experience, judges two and three, showed high correlations (.001 level of significance) when compared to the regionally rated judge.

SCORING

In a meet, all of the judges' scores are collected and turned into the superior judge. The superior judge discards the high score and the low score. The middle scores are then averaged. The difference between the highest and the lowest of the two middle scores must not be greater than:  (for preliminary routines)

- 0.30 point for scores between 9.50 and 10.0
- 0.50 point for scores between 8.50 and 9.45
- 1.00 point in all other cases

Concerning the finals on each apparatus, the entire difference between the scores will be:

- 0.20 point for scores between 9.50 and 10.0
- 0.50 point for scores between 8.50 and 9.45
- 1.00 point in all other cases

The average score must also be within one point of the superior judge's score. If the average score is in range with the superior judge's score it is recorded. If the two middle scores are not within
one point of each other, the two judges must conference with the entire panel of judges and "the judge farthest away from the superior judge must adjust her score." The average of these two adjusted scores is then recorded (5).

Hunsicker and Loken (18) examined the effect of averaging all the judges' scores (four scores) rather than averaging the two middle scores. The scores from the National Collegiate Athletic Association Gymnastic Meet held at the United States Military Academy in 1950 were used. It was shown that if the scores of all four judges were used in determining results, definite changes in individual standings resulted. The major advantage of the net score, especially for inexperienced judges or difficult to judge routines, is that it prevents an extreme score from unduly influencing the mean performance score (20).

When the four judges' scores were averaged for this study, no change in individual standings resulted except for a tie for first place on bars. When the same thing was done for the video-taped scores a definite change in individual standings was made in the floor exercise routines and vaulting, using the four judges' scores instead of averaging the middle two scores. In comparing the individual standings between the live and video-taped scores, all of the individual standings for each set of routines was changed except for the routine receiving the highest score. This may be due to the angle at which the routines were judged and the two dimensional viewing of the video tape.
RANGE OF SCORES

Calkin (4) designed a computer program which affords a more objective look at a judge's performance in a meet situation. The scores of each judge and the meet scores are punched on IBM cards for each contestant in each event of the meet. The program output first gives the number of times each judge's score was discarded because it was high score. Then the number of times each judge's score was discarded as low score is recorded. The program gives the mean of all the scores given by each judge. This shows at a glance which judges on the panel were generally high and which were generally low in their scoring.

For this study, Table VI shows how many times each judge's score would have been discarded because it was the high score or the low score for both the live and video-taped performances.

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<td>II</td>
<td>III</td>
<td>IV</td>
<td>V</td>
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<tr>
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<td>0</td>
<td>7</td>
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<td>LOW</td>
<td>1</td>
<td>4</td>
<td>6</td>
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<td>V-T</td>
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<td>3</td>
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<td>LOW</td>
<td>4</td>
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TABLE VI
Five of the live performance scores would have been adjusted scores in a meet situation as the two middle scores were not within one point of each other. Three of the live performance final scores and two of the video-taped final scores were out of range with the superior judge's score and in a meet the average score would have been averaged with the superior judge's score.

The general agreement of scores between all five judges was good. There were cases of extreme scores. This may have been due to the angle at which the judging was done or the criteria applied to an individual routine.

DISCUSSION

All of the judges must know the compulsory routines they are judging thoroughly, so the entire judging panel is applying the same criteria in obtaining scores. Some discrepancies in scores may be due to the angle at which the judging is done. Each judge is stationed at a different location to provide as many viewing angles as possible. In judging vaulting, the judges viewing the post-flight angle of the vault may not see all the errors made in the pre-flight and the scores would vary accordingly.

Judges one and two demonstrated that judging experience with live and filmed routines or experience (per se) related to a higher correlation between filmed and live performance scores. In view of these
results an opportunity to judge filmed routines should be available so
judges can become familiar with viewing taped routines before
having to judge them on a national rating practical test.
CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

SUMMARY

The purpose of this study was threefold:

1. to test the relationship of scores awarded a live performance and those awarded a video-taped performance,

2. to test whether the difference between a routine viewed live and on video tape is significant.

3. to see if inexperienced judges judge as consistently as experienced judges when rating filmed performances.

The judging of live routines took place in the Women's Center Gymnasium during Winter Quarter 1971. Each judge was instructed to evaluate the routines as they would at a gymnastic meet. In order for a comparison of each judge's live scores to be tested, each routine was video taped. Eight days later the same panel of judges evaluated the video-taped routines. No judge's conferences were held and no comparison of scores between judges was made. When the scores were analyzed, the judges with the most experience in gymnastics and in judging routines had a higher correlation between filmed and live performance scores and a significant difference between means of the live and video-taped scores.
CONCLUSIONS

On the basis of these results found in this study several conclusions can be made:

1. In this study experienced judges had higher reliability coefficients when scores for live and video-taped scores were related. These judges seemed to use the same criteria in awarding scores to a video-taped routine and live performances.

2. Experienced judges scored video-taped routines significantly lower than live routines. The less experienced judges participating in this study did not consistently judge filmed routines higher or lower than live routines.

3. The relationship of judges to the regionally rated (superior) judge showed highly objective scores for the experienced judges and less objective scores for the novice judges.

RECOMMENDATIONS

In view of the findings of this study the following recommendations are made. Additional study is necessary:

1. to determine if training beginning judges with filmed routines is an asset to their ability to judge live performances,
2. to determine if experienced judges award similar scores for optional routines judging filmed and live performances.

3. to see if camera angle constitutes an appreciable influence on the scores judges award filmed routines.
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APPENDIX
APPENDIX A

STATISTICAL ANALYSIS

I. FORMULA FOR COMPUTING CORRELATION--PEARSON r

Pearson r -

\[ r = \frac{N \sum XY - (\sum X)(\sum Y)}{\sqrt{N \sum X^2 - (\sum X)^2 \times N \sum Y^2 - (\sum Y)^2}} \]

II. FORMULA FOR TESTING SIGNIFICANCE OF r

\[ t = \frac{r}{\sqrt{1 - r^2}} \sqrt{N - 2} \]

III. FORMULA FOR COMPUTING t TEST

\[ t = \frac{\sum d^2}{\frac{\sum D^2}{N} - \frac{(\sum D)^2}{N}} \]

\[ S_D = \sqrt{\frac{\sum d^2}{N}} \]

\[ S_{\bar{D}} = \frac{S_D}{\sqrt{N - 1}} \]

\[ t = \frac{\bar{X}_D}{S_{\bar{D}}} \]
APPENDIX B

HIGH-INTERMEDIATE LEVEL COMPULSORY ROUTINES

I. Balance Beam

Position: Stand facing the right one-third of the beam.

1. Take several running steps with double take-off, jump to squat position on beam, both feet between hands. Immediately turn 90 degrees to the left with arms sideward.

2. With weight on right foot, rise to upright position. Large chassé step forward left, close right, step left with right arm forward, left arm sideward. Repeat chassé R-L-R with left arm forward, right arm sideward.

3. With weight on right foot, kick left leg upward (high), right arm forward and left arm sideward. Swing left leg downward backward and turn 180 degrees to the left. Step forward with left foot to lunge. Both arms swing downward forward and obliquely upward on turn.

4. Arms swing sideward, downward, and forward to grasp beam with hands. Forward roll to free V-sit with arms sideward. Straddle legs, hands grasping beam between the legs. Swing legs downward backward to knee scale. Right knee on beam with left leg extended backward upward.

5. Swing left leg forward, step on left foot, rise to upright position, raising arms forward upward and sideward.

6. Rapid steps forward R-L-R, arms sideward. Step with left foot forward, both arms swing to the right, sideward and backward. 180-degree moderate arabesque turn to the left, weight on left foot, arms sideward.

7. Step forward with right foot, rapidly place left foot behind right foot, pose on tiptoes, legs stretched, arms swinging obliquely downward to backward, palms down, and head raised.

8. Step-hop on the left foot, right leg in croise (knee lifted high and turned outward with right foot slightly crossed in front of left leg), left arm forward, right arm backward, head slightly to the left.
9. Repeat on right foot. Step forward L, R. 180-degree squat turn to the left, arms sideward.

10. With weight on right foot, straighten left leg forward and swing both arms forward and downward to grasp beam. Swing left leg downward, backward, and upward. Transfer the weight of the body forward to hands, join both legs momentarily behind body above the horizontal (momentary free lay out support), straddle legs swing them downward through straddle seat, and backward roll over the head to a squat on left foot. (Shoot extended right leg backward upward above horizontal before placing weight on left foot in squat.) Swing right leg forward, place right foot on the beam, and simultaneously swing arms obliquely backward to the low rear, palms down, trunk and right knee bent.

11. With weight on right foot, rise to upright position. Arms remain in oblique low rear.

12. Run forward L-R, arms sideward. Leap left with right arm forward and left arm sideward. Step forward with right foot, raise left leg into scale, left arm forward, right arm sideward.

13. Rise to upright position, arms upward overhead, and place left foot in front of right foot. Swing arms forward, downward, and backward, trunk and knees bent, and simultaneously jump, and change feet. Land with knees bent and trunk inclined forward.

14. While swinging arms forward upward to sideward, rise to upright position, weight on right foot. Modified step-hop forward on left foot as right leg kicks forward upward. Step right, place hands on beam, and right roundoff dismount at end of beam. Arms swing downward forward and upward during the right leg kick to roundoff. Legs are bent in landing, arms raised overhead, and as legs straightened, arms are lowered to sides.

II. Floor Exercise

1. Step L, cross behind R foot, step R sideward, and step L across in front of R foot; arms are out sideways with a slight bend of the trunk to the L, head L.

2. Quarter-turn R (90 degrees), stepping R forward and lowering the arms to raise them parallel to the R. Without stopping step with L foot to the L, thrust L arm directly out to the side and pivot on the left foot to make a one and three-eighths (495-degree) turn to the L. The R leg is half bent forward with the toe of the R foot touching the L leg; arms are vertical and slightly rounded.
3. Place R foot forward. R leg is bent, arms are obliquely down and back sideways, palms down, slight turn of trunk to the R, head turned R (lunge).

4. Chassé with lowering R arm in order to bring it up to the horizontal. Step R forward, arms relaxed. Step L forward and leap—R leg forward, L back, and exchange legs in the air (scissors leap); L arm backward, R horizontally forward.

5. Land on L foot, two steps forward—R—L, and leap from L foot executing a small turning leap to the L, arms sideways. Land on the L foot with the R leg extended to the rear, similar to a leg swing turn.

6. Without a stop, step R backward, bend the knee, sit down, and backward roll with manual support, finishing on L foot.

7. Place R foot back, bring L foot alongside the R foot, straighten the body by bringing the R arm from forward position backward to end rounded in front of thighs. L arm raises forward to the vertical, arm rounded.

8. Three-eighths turn to the R, step R sideways and without stopping, slide pointed toes of L foot behind the R foot, L leg half bent, heel raised, R leg slightly bent; arms are relaxed and parallel to the R; slight flexion and twist of the bust to the R, head R.

9. Three steps L sideward turning half-turn to the L with each step. End with toe of pointed R foot behind L foot, legs slightly bent, arms parallel to the L and slightly bent, slight twist of the bust to the L, head L.

10. Three steps R sideward making a one and one-quarter turn to the R. The L arm stays out to the side, the R arm goes to the front rounded horizontal position, opens out to the side, and without a stop raises flexibility to the vertical rounded position and returns foredownward to the front rounded horizontal position. Hop on R foot while raising L leg forward, arms raised obliquely upward.

11. Dive cartwheel to the L landing on R foot, arms sideways. Quarter-turn L and three steps forward, L—R—L. Bring R foot next to left on toes, body extended, arms obliquely downbackward, head raised.

12. Quarter-turn L, step L forward, leave R foot in place behind L and thrust with R foot as you jump forward onto L foot, R leg raised backward, L arm out sideways, R arm horizontally forward, step, tap, and push off from both feet to land L. Step
forward on R foot, little hop on R leg, L leg raised in back, with
small turn to R; R arm raises foreupward to the vertical, slightly
bent, palm up, left arm obliquely downbackwards.

13. Step back on L foot, half-turn to R. Step forward on R foot and
hop on R foot with flexion of the L leg forward; simultaneously
move arms out sideways and keep moving them, terminating with
the L arm rounded horizontally forward. The L arm moves to the
forward rounded horizontally forward. The L arms moves to the
forward rounded horizontally position and continues foreupward
over the head. Step forward on L foot to a L one-arm cartwheel,
thrusting the L arm to the side with the weight placed upon the R
arm. Land on the R foot, close the L foot to the R and raise the
heels off the floor as the body straightens.

14. Large step of R foot to rear, placing down the top of the foot. Kneel
on R knee, point L foot, sit on R heel, twist the trunk to the R while
lowering the arms in succession--R then L, and bring them up
parallel oblique to the R, head R.

15. Stand up on L foot and without stopping thrust L arm sideways and
turn seven-eighths to the L on ball of L foot, R leg raised in back,
arms out sideways.

16. Two steps forward, R-L, lowering the arms, rear scissors to
alight on R foot, bringing arms forward to vertical. Two steps
forward, L-R, bringing arms down forward. Hop on R foot with
L leg in half bent forward, arms obliquely behind.

17. Step L forward leaving the R foot in place. Thrust with R foot and
jump and land on L foot, R leg raised in back. Leap forward
thrusting the L foot backwards and land on R foot, arms rounded
below in front of body. Arabesque on R leg, L leg raised high in
rear, R arm extended obliquely foredownward, L arm extended
obliquely backward, parallel to L leg.

18. Straighten the body and step L forward on toe, R leg lifted in back,
R arm vertical, L arm out sideways; slight extension of the body
raising the head. Run forward two steps, R-L, lowering arms
sideways, and then hop on L foot raising R leg forward; arms
obliquely upward.

19. Step forward on R foot and execute a tinsica. Land on L foot, R
leg raised forward, arms vertical. Without stopping, step R
forward lowering the arms sideways; one step on L foot, leg bent,
R arm horizontally forward, L arm sideways.
20. One and three-eighths turn to the R on the L leg. R leg bent forward, arms rounded horizontally in front of body. Two steps forward, R-L, arms sideways. Cat-jump simultaneously circling arms crossed from below upward in front of body. Land on R foot, one step with L foot, arms open out sideways, one step with R foot, legs slightly bent, L toes pointed in rear. Round back and bring arms forward flexibly at either side of the head, palms downward. Movement is contradiction in the upper body; head is down.

21. Straighten the body, arms out sideways. Three steps to the R, L foot crosses in rear, R step sideways, L crosses in front. Lower the arms and turn to R three-quarters on the L foot. Step back R and then L.

22. Thrust R leg foreupward and back walkover, landing on R foot. Step back on L foot and bring R foot beside L one on toes, arms sideways.

23. One-eighths turn to the L and take steps, R-L-R, in a curved pattern, making a small circle with the R arm forward. Pronate and supinate like the inward half of a figure 8.

24. Turn to the L to continue the curved pattern by taking three steps backward, L-R-L. Describe the same small circle with the L arm.

25. Half-turn on last step to step, R-L-R in three Chené turns. Fast step turn a half-turn to the L. Arms are behind the back, hands on the hips.

26. Continue the last turn one-eighth to run backwards toward the corner of the floor area with three rapid steps, L-R-L, bringing arms forward and up to vertical. Body is slightly rounded in run backwards and straightens to a toe stand. Bring R foot beside L foot on toes, body and arms extended in pose.

27. Step-hop lifting free leg straight forward and upward. Arms move forward, down and to the oblique rear. Take three running steps hopping on the third step with free leg again raised forward, arms obliquely upward. Step and execute a handspring with a walkout.

28. Step forward to pose, leg extended in back with same arm vertical, other arm forward with support leg. Head turns to look to the side over the forward arm. Hold, step to the side, and finish.
III. Uneven Bars

Position: Stand outside of and facing the low bar.

1. Run and take off on two feet from a beat board, placing the hands in an overgrip. Jump to a free front support and turn backward into a back hip circle finishing in a front support.

2. Double leg squat through over low bar to a rear support.

3. Grasp the high bar in a crossed mixed grip, L hand crossed over R and in regular overgrip, R hand in undergrip. Shoot the legs upward to extend body position (underswing), 180-degree turn L around L arm, and swing body to low bar.

4. Pike at hips on contact with low bar and whip legs backward; straddle with a high lift of hips over low bar to a rear lying hang.

5. Place R foot on low bar, extend L leg upward, and single leg stem-rise to a front support on high bar.

6. Swing legs forward, then backward to free front support, stretch out to an extended body position, swing forward under low bar, transferring hands to overgrip on low bar as body hep circles backward on the low bar. Open body to a momentary front support.

7. Single leg cut to a stride support. Cast, and shifting the weight to the L arm, bring the R leg sideward, up, and over the bar cutting under the R hand, which is displaced, and return R arm to support on the outside of the leg as the legs arrive in a stride support.

8. Reverse or undergrip with both hands and execute a R front leg or stride circle.

9. Move R hand over to the other side of the R leg and grasp the low bar in a regular overgrip, fingers towards the high bar. At the same time lift the L arm backwards to the high bar with a regular grip. Simultaneously make a 180-degree turn L ending in a stride support with L leg forward.

10. Cut the L leg backward and cast with good amplitude to a squat stand on the low bar.

11. Rise to a stand and grasp high bar with overgrip. Swing R leg sideward and forward over the high bar, regrasp the high bar with the R hand in a regular grip on the outside of the R leg. Change the L hand to a reverse or undergrip and pull body up into a stride support on high bar.
12. The R hand reaches across the body to the other side of the L hand and grasps the bar in a regular grip, the weight shifts to the R arm, and the body makes a 180-degree turn L while the L leg is swinging sideward and backward over the high bar to a front support.

13. Dismount. Change the R hand to a reverse or undergrip. Place the L hand in a regular grip on low bar and body pike at the hips. Cast or whip body to extend position and cartwheel dismount over the low bar ending in a stand, L side facing the bar.

IV. Vault

Straight Body Ascent-Stoop Vault.