

Application of Biofeedback in the Training of Radio and Television Broadcasters

Biofeedback-en aplikazioa irrati eta telebista komunikatzaileen prestakuntzan

Aplicación de biofeedback en la preparación de los comunicadores de radio y televisión

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Abstract

The training proposal that we have tested includes, along with traditional learning techniques, psychological strategies so that the individual can better face a typically stressful situation: speaking in public and holding the waning attention of the audience. The application of biofeedback techniques helps the communicator to approach an optimum state for managing the personal distance of emotional communication that dominates the public space.

Keywords: Emotional communication, communicative anxiety, biofeedback, flow, television.

Laburpena

Lan honetan komunikatzaileen prestakuntzarako programa bat proposatzen dugu. Lokuzio ikastaroen eduki konbentzional ez gain, programak estrategia psikologikoak barneratzen ditu, parte hartzaileek oso estresagarria izan daitekeen egoera bati aurre egiten ikas dezaten, hotz, jendaurrean hitz egiteari audientzien arretari eutsiz. Biofeedback tekniken aplikazioa lagungarri zaio komunikatzaileari bere egoera psikologiko hobereenera hurbiltzeko, eta horrela, eremu publikoan nagusi den komunikazio emozionalari dagokion distantzia pertsonalean hobeto moldatzeko.

Gako-hitzak: Komunikazio emozionala, biofeedback, fluxua, telebista.

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Resumen

La propuesta de formación que hemos ensayado incorpora –junto al aprendizaje convencional- estrategias psicológicas para que el individuo pueda afrontar mejor una situación típicamente estresante: hablar en público y mantener la atención menguante de las audiencias. La aplicación de técnicas de Biofeedback ayuda al comunicador a acercarse a su estado óptimo para desenvolverse en la distancia personal de comunicación emocional que domina el espacio público.

Palabras clave: Comunicación emocional, aprensión comunicativa, biofeedback, flujo, televisión.

0. Introduction⁴

Traditionally, the training of radio and television broadcasters has run up against an obstacle that blocks their learning: fear of speaking in public. Successive generations of professionals have felt a disproportionate fear of speaking in front of others, which is especially noticeable in the initiatory stages.

Later, this initial stage fright tends to disappear as a result of the spontaneous apprenticeship that takes place in professional practice; however, the desperate fight for audiences increases this pressure associated with a typical situation of social evaluation. In such circumstances, there is the risk of a stressful experience becoming chronic, and thus compromising the health of the individual and her communicative capacity throughout her working life.

Paradoxically, academic training turns its back on the emotional control of professionals. They are not given preparation for the demands of the new scenario of proximity that dominates communication. This blind spot in training is an error that could be compared in scale to a hypothetical persistence of monophonic sound in our study plans, with a deaf ear turned on stereophony. The imbalance has become more evident now that a new emotional rhetoric has overtaken the approach of broadcasters who represented a more distant and formal relationship, in favour of a greater proximity to audiences. The functions of the new communicators are becoming wider, moving into the foreground, both in their presence on the screen, and in their central role in speaking, on programs whose names are now those of the hosts themselves.

The acceleration of the processes of technological and professional convergence is giving rise to even more uncertainty in the enterprises and their professionals. The reform of the study plans is an opportunity for revising the way in which the University accompanies these social communicators in this period of change.

What we propose here is a training model that integrates all the processes included in this orchestral communication that, besides voice management, involves the mind of the individual, and also her body, which is a real amplifier of her personal expression.

Instead of perpetuating a partial training that ignores the emotional communication of the individual, for more than a decade we have been testing a model based on the concept of flow (Csikszentmihalyi, 1990). According to this proposal, when there is a balance between a difficult task and the personal skills needed to confront it, ideal conditions are given for an optimum performance by the subject. In this way, the latter will be prepared and motivated for showing the best side of herself: maximum effectiveness in her communication, as well as maximum satisfaction and enjoyment of the activity on which she is concentrating. And vice versa, when she feels that the level of requirements

⁴ Este artículo expone los resultados obtenidos en una investigación financiada por la UPV-EHU a través del proyecto EHU 06/74. Queremos agradecer a los profesores Pedro Barea Monge, del Departamento de Comunicación Audiovisual y Publicidad, y a José Ignacio Cea, del Departamento de Enfermería 1, su participación decisiva en el grupo investigador que realizó este proyecto.

exceeds her abilities, she might disconnect from the activity, dominated by an excessive anxiety.

This article presents research in which we use Biofeedback techniques as a kind of mirror, so that the subjects are conscious of their level of activation and can regulate this at will. This facilitates the self control of the above mentioned excessive anxiety and the development of their own communications style so that they can perform more fluently.

Maintaining intelligent communication with audiences involves – along with due responsibility in the selection and preparation of content – revaluing the role of the emotions in order to improve understanding of the message and getting audiences involved, who are increasingly saturated. Otherwise the risk is run of abandoning the public space to professionals who manipulate the interests of everyone to their own benefit. Or of trusting in the voluntarism of those who distrust the functionality of the emotions and neglect their public expression, giving rise to general indifference. Good emotional control by these communicators – and by society as a whole – is of general interest in order to fertilise the largest shared space of our societies, which is today managed by the mass media.

1. Emotional Communication and Stage Fright

The need to attract attention in such a crowded communication system forces broadcasters and communicators to abandon a more formal social distance and to attend to the users in the first person – as if in a face to face conversation – within a basically emotional distance of exchange (Hall, 1969). This scenario of proximity tests both the interpretative skills of the subject and her emotional intelligence. *We are a unit; our body reacts as a psychical, emotional and muscular whole facing certain stimuli. Similarly, our communicative style is mediated by the way in which we perceive the setting and how we perceive ourselves* (Bustos, 2003: 24).

Together with the fear of snakes and the void, speaking in public is considered a laboratory stress factor, which gives rise to widespread concern because many individuals do not feel themselves equal to it. This negative perception of the situation gives rise to an attitude of fear that is shown through an excess of tension, clumsiness in expression, evasiveness in the communicator, and even avoidance of public exposure.

Stage fright is what most commonly interferes in the development of personal expressiveness. McCroskey (1984a, b) defined the concept of communicative anxiety as the level of fear or anxiety that an individual feels associated to real or anticipated communication with another person or persons. The majority react in a highly disproportionate way facing such exposure to the judgement of others. Different studies have shown this widespread incidence of fear of speaking in public in the adolescent, university and adult population (Bados, 2001).

The way in which this typically stressful situation – speaking in front of cameras and microphones, and subjecting oneself to the judgement of others – is perceived by each individual has a decisive influence on her expression. A “communicating vessels” relation exists between the individual’s perception of the situation and her communicative capacity. Young communicators also feel affected by this exagge-

rated stage fright, which is the main obstacle to their expressing themselves more self-assuredly on radio and, especially, on television.

In its turn, this exaggerated perception of a situation involving social evaluation is highly conditioned by the individual's emotional state. Successive research has shown that lack of confidence increases the discomfort of a subject facing the judgement of others. And vice versa: all the participants agreed on the special importance of positive reinforcement for shoring up their confidence, put to the test in what is for them a strange and potentially stressful situation, in which they are required to act with an extraordinary naturalness (Toral, Murelaga and Vidales, 2008).

This gives rise to an *infusion effect*, by which the attitude of the communicator impregnates her communicative behaviour, emotionally infecting the audience both when she feels at ease and when she feels uncomfortable (Forgas, 1991). The emotions felt by an individual are enacted on the stage of her own body – often unconsciously – using the most persuasive resources of non-verbal language (Damasio, 1999), which the audience perceives with special interest. The image and the voice of the communicator act in unison, like a loudspeaker that amplifies and expands her mental, emotional and physical state (Dewhurst, 1993). This explains the need for understanding and harmonising all of the resources that come into play in an orchestral communication so that no instrument should be out of tune.

Lack of communicative skills or preparation increases communicative anxiety that McCrosky (1984a) terms *rational*. But, even when communicative skills are satisfactory, this author detects a high level of *non-rational* anxiety. Thus, an experience as disproportionate as stage fright is only the tip of an iceberg, whose submerged surface conceals the individual's lack of confidence – whether justifiable or not – in her communicative skills. A great lack of confidence generates an anxiety that overwhelms her, to the point where she expresses herself with obvious clumsiness. On the contrary, feeling at ease in front of the cameras and microphones is the individual's most resounding way of expressing herself, based on the confidence she shows in her skills and her concentration on the task at hand.

That is why we insist on the need for both understanding and giving equal training to all of the physical and mental processes involved in the individual's expression and her perception by others. The distinction between rational and non-rational anxiety guides the interventions aimed at improving communication quality through developing communicative skills – thus reducing rational anxiety – and/or reducing non-rational anxiety.

Learning to cope with stage fright and strengthening the personal style of the communicator are therefore two faces of the same task: the necessary emotional literacy of communicators that enables them to better understand themselves and to express themselves in their own style in the new scenario of emotional communication that dominates public communication.

1.1. Fluency in Communication and Use of Biofeedback

It is clear that in the training of these communicators, perceptions come toge-

ther that are potentially threatening to the individual: a typically stressful situation of social evaluation, aggravated by academic evaluation. Lack of clear ideas and skills for better confronting an unknown situation only increases the difficulty of the test. This also awaits them in the exercise of a profession whose continuity is highly mediated by their communicative efficacy, subjected to permanent evaluation through audience ratings.

A well-known psychological formula is the so-called Yerkes-Dodson Law (Yerkes and Dodson, CB, 1908) which explains how, in order to achieve optimum performance in any human activity, a certain tension is required – alertness in the form of stage fright in the case that concerns us here – which activates all of the subject's senses, concentrating all of her energies on the task at hand. But there is also a point of inflection, starting from which every increase in pressure is harmful, to the point of reducing performance. Hence the great importance for each individual of controlling her optimum level of activation in communication, and of developing resources for reaching this level at will, thus preventing an excess of anxiety from ruining both her health and her public expression.

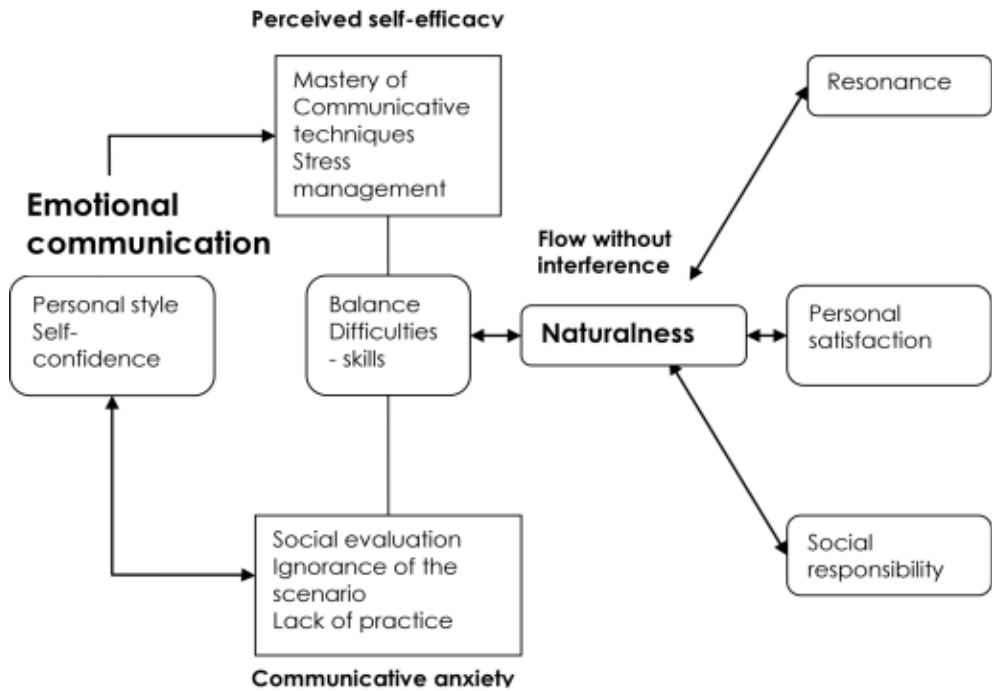
Just as Rhetoric facilitates the acquisition of communication techniques, the brain and the body can also be trained to become free of unwanted interference. The training proposal we have tested aims to confront, in a more ergonomic way, this relevant laboratory stress factor: *how not to run away, how to relate better and how to think differently* (Legerón, 1997: 167). The aim is to unlearn a style of acquired defencelessness that leads the individual to avoid public exposure, thus paradoxically feeding this very fear. This training involves control of the individual's voice, and of her mind and her entire body, which acts as a kind of amplifier of the communication emitted by her verbal and non-verbal communication channels.

The aim is to develop the necessary skills for improving communication capacity through training in communicative techniques, experimenting with psychological tools for confronting non-rational anxiety in communication, and exposure to practice with positive reinforcement.

This combined program seeks to have a direct positive effect on the individual's perception of her self-efficacy. Bandura defines self-efficacy as the individual's beliefs concerning her capacity to put her skills into practice in a specific situation (Bandura, 1997). Just as McCroskey (1984a) referred to the rational and non-rational avoidance of communication situations, Bandura takes account of the individual's beliefs in the inadequacy of her skills, both where they are objectively based and where they are unfounded. In both cases, her belief in an inadequate capacity gives rise to anxiety, while a perception of balance between capacities and requirements facilitates an optimum experience.

Mijalyi Csikszentmihalyi's concept of *flow* on which this training proposal is based – see Figure 1 – is understood as the optimum situation for performance in any human activity. This experience of fluency is reached when the skills and the requirements posed are balanced, and the individual feels attracted by a task that keeps her fully absorbed. This is an intrinsically pleasant experience, in which a clear view of the aims puts the individual to the test and enables her to express herself better.

Figure 1: **Experience of flow.** Optimum personal state for public communication. Prepared by the authors.



The basic antecedent of such a productive state of *flow* is thus a balance between personal skills and the requirements of a situation which keeps the individual motivated and with all of her senses working on the task at hand. Only the confidence given by feeling herself equal to the perceived challenge enables the individual to give the best of herself, in a highly gratifying experience of optimum performance. And vice versa, the opposite of this state of flow is an overwhelming anxiety produced by a level of requirement that exceeds the individual's capacities and disconnects her from the activity she is engaged in.

We have employed Biofeedback techniques as a kind of mirror to make the subjects aware of the automatic responses made by their bodies, so that they will immediately note their level of activation and decide on a response. *To simplify matters, it can be said that biofeedback consists in offering information on the state of a biological process, hence any technique that provides a person with information on her physiological activity, thus enabling her to voluntarily control that activity, could be considered a biofeedback process* (Carrobes and Godoy, 1987: 31).

Although these techniques are not normal resources in the communication sciences, their efficacy has been sufficiently demonstrated in other areas. In their review of the outset and technical evolution of biofeedback in clinical psychology, Conde

and Menendez (2002) report its efficacy in reducing stress and general anxiety. Specifically, treatment with biofeedback of the heart rate has been used in cardiovascular diseases related to anxiety. Biofeedback is also commonly used in sports psychology for the improvement of sports' performance or optimization of sports' efficiency (Godoy, 2004; Edmonds, 2005).

Biofeedback offers the subject instant information which will enable the individual to control her system of physiological response in the absence of feedback. Finally, the aim is to achieve the generalisation and maintenance of personal self-control without the assistance of these techniques.

2. Method

2.1. Sample

This experiment involved 24 students from the degree courses in Audiovisual Communication, and Advertising and Public Relations. They had chosen the optional subject of *Broadcasting on Radio and Television* and were aged between 20 and 22. Nineteen were women and five men, a proportion that corresponds to the presence of both sexes on these degree courses. The research was integrated into the routines of this second term optional subject. Given that all the students showed an interest in taking part as members of the experimental group that would be carrying out the additional exercise of breathing control, we proceeded to initially assign by random ten subjects to the experimental group and ten to the control group. Four students who joined later were included in the control group. Three of the five men were included in the control group and two in the experimental group.

2.2. Procedure

All of the participants were recorded presenting a news story for a television news program before the course (the same story for all of them), and a second recording of another news story at the end (also the same for all of them). In both recordings the heart rate of the participants was registered. Besides this, immediately after both exercises, the participants answered questionnaires that measured the level of anxiety associated with broadcasting and the psychological state during this. The two recordings were later viewed by a panel of ten experts who evaluated the quality of the broadcasting.

2.2.1. Common program for the whole group of students

Cognitive restructuring: Throughout the training program, the students' confidence was strengthened by detecting the most recurrent negative thoughts and replacing them with others that were more balanced. These cognitive interventions (Schmidt, 2006) are based on the idea that negative thoughts about a communication situation provoke anxiety and hence if those negative thoughts are treated, anxiety can be reduced.

Cognitive restructuring teaches people to identify their negative thoughts about the communication situation, to design or create positive alternative phrases, and to use them to counteract the negative thoughts. The therapy of altering cognitive orientation tries to replace an orientation towards the activity with an orientation towards communication; that is to say, instead of concentrating on the fact that everyone is looking at her, the subject must think about the opportunity for sharing ideas with the audience.

Participants were asked to write negative thoughts that came to their mind before and during broadcasting exercises. Then, students themselves evaluated the degree of adequacy of those thoughts to the situation and proposed some alternative ones, more adaptive and positive. In the remaining broadcasting exercises, they were instructed to detect any spontaneous negative thought and change it to its alternative positive one.

Visualization: Instead of using the power of the imagination in a negative way, the participants in the course were helped to think in a more productive way through the practice of visualisation. Mental visualisation exercises can strengthen the individual's confidence by anticipating the experience of the desired scenario. Hall, Mack, Paivio and Hausenblas (1998) have described how visualisation can be used with a cognitive and/or motivating function. Within the cognitive function are included the recreation of concrete skills (e.g. imagining oneself pronouncing a difficult word or phrase correctly, or adopting a specific posture or facial expression...), and the rehearsal of strategies (e.g. imagining oneself continuing with the presentation in spite of making a mistake). Within the motivating function are included recalling objectives (e.g. imagining oneself being congratulated by the others once the presentation is over), helping to control activation (e.g. imagining oneself controlling the stress provoked by the situation and remaining calm), and fomenting a feeling of control, mental concentration and focussed attention (e.g. imagining oneself centred when facing an unforeseen situation).

Following this model, students practised visualization of different relevant scenarios and were instructed to engage in visualization during 5 minutes previous to their broadcasting exercises.

Exposure: Two-thirds of the course time was dedicated to continuous exposure to, and familiarisation with, practical radio and television activity. The aim was to deactivate the worst-adapted automatic behavioural responses, such as concealment and evasive conduct.

Theoretical program: The teaching plan of the Broadcasting course also included a theoretical program for understanding the workings of the voice and basic techniques in this matter. This was not a question of imitating a concrete model, instead it involved each student adapting this learning to her own needs, so that she could experience, recognise and develop her own style of communication.

2.2.2. Biofeedback

After evaluating the secondary effects of the different monitoring systems on broadcasting activity, we opted for registering the subject's cardiac activity. To this end we chose to use pulsometers similar to those used by sportspeople – a type of wrist-watch and tape with a sensor on the heart – easily recognisable by the experimental

subjects. Their low level of interference in television communication finally led us to choose this device that measures an activity directly related to the variations of relaxedness and emotional load of the subject.

The participants in the experimental group were made familiar with breathing techniques due to their simplicity and efficacy when it comes to reducing the over-activation characteristic of stressful situations (Conde and Menéndez, 2000). Practice in more complete breathing has shown its effectiveness in reducing levels of stress and anxiety, and cardiac frequency. The different emotions have a different breathing pattern, hence the possibility of regulating breathing cycles, returning them to normality when they deviate from this (Gatchel and Proctor, 1976; Cea et al, 2004).

During the five weeks following the first recording, the subjects of the experimental group, together with their radio practice, were trained in a technique of breathing control of proven efficacy in reducing the heart rate (Reyes del Paso et al., 2005). Each exercise lasted for ten minutes and was inserted naturally into the overall training program, common to all students. Simultaneously, the students in the control group carried out their practice for television, which meant that the two groups were physically separated. In this way the additional training of the experimental group did not become evident, which could have been a significant factor contaminating the results.

During the breathing exercises, at the same time as their heart rate was registered, biofeedback was used to help the participants identify their level of activation and become aware of its alteration through the breathing technique. Their base heart rate had been measured previously in a situation of calm. The pulsometers were programmed to emit an intermittent signal when the heart rate rose above the base level during the breathing exercise. In the three last exercises, after the subjects had become familiar with the breathing technique during the first two sessions, a task was introduced to be carried out simultaneously while maintaining the breathing rhythm. This task consisted in mentally counting downwards from one thousand by subtracting sevens. The aim was to increase the level of stress so that the subjects would train themselves to reduce its activation through breathing, and could test the efficacy of this through the biofeedback.

The students in the experimental group were instructed to apply this breathing technique without biofeedback immediately before their remaining weekly broadcasting exercises. This is a common procedure in training with biofeedback. The final aim is the subject to be able to carry out her task without the help and interference of this monitoring. A comparison of the results of the experimental and the control groups will tell if biofeedback training is helpful in better improving communication quality in the experimental group.

The aim was to test whether the Biofeedback technique, combined with a breathing control procedure, could neutralise the excess of anxiety produced by exposure to broadcasting situations. It also aimed to check the extent to which the students perceived that they were approaching their optimum state. Finally, it aimed to determine whether this reduction in anxiety was visible to an external panel made up of ten experts, who evaluated the quality of the first and last recordings of the course, both of a news program.

2.3. Instruments of evaluation

2.3.1. Heart rate. Polar brand pulsometers (model RS400) were used for registering heart rate and applying the biofeedback.

2.3.2. Scale of distance with respect to optimal psychological state. Immediately after making the first and last recordings, all of the participants indicated how they had felt during the recording on the scale that appears in Table 1.

Table 1. Scale of distance from optimum psychological state.

Please indicate how you felt when making the recording. Mark an X in the box that best reflects your experience:

Excessively relaxed	Somewhat relaxed	Well	Nervous	Excessively nervous
1	2	3	4	5

This scale was created taking into account the theory about the optimal psychological state related to maximum performance. According to this theory both an excessive activation and an insufficient activation prevent each individual from performing at his/her maximum level. It can therefore be considered a scale for measuring the distance with respect to the subjectively defined optimal psychological state.

2.3.3. Anxiety level. All the participants answered the State-Anxiety Questionnaire (STAI) immediately after the first and the last recordings. The Spanish version adapted by TEA was used (Spielberger, Gorsuch and Lushene, 1982).

2.3.4. Communication quality. A panel made up of ten experts evaluated the quality of the first and last broadcast of all the participants. They used a semantic differential scale designed to measure the degree of perceived confidence and credibility of a television broadcaster (see Table 2).

Table 2. Semantic differential scale designed for evaluating the perceived quality of communication.

Uncomfortable	1	2	3	4	5	Natural
Insecure	1	2	3	4	5	Secure
Distant	1	2	3	4	5	Close
Confused	1	2	3	4	5	Clear
Not credible	1	2	3	4	5	Credible

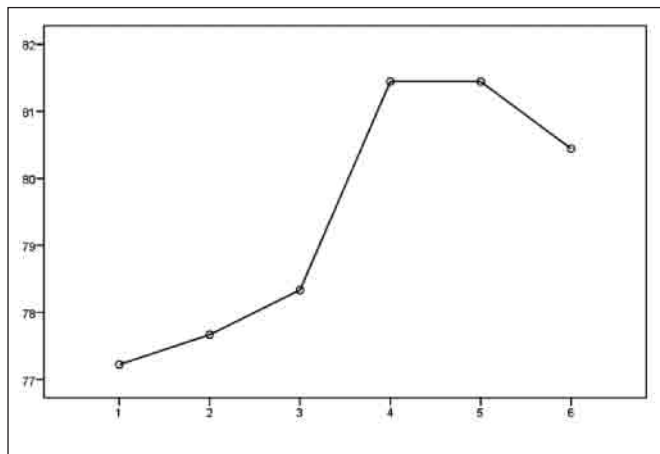
2.3.5. Qualitative account of the training experience. At the end of the course, all the participants wrote up a Life story, recounting the difficulties and helpful aspects they had found in their training. In this way, we were able to determine their personal perception of the experience.

3. Results

3.1. Evolution of average heart rate during training in breathing

As can be seen in Figure 2, the average heart rate rises slightly in the first two exercises (points 2 and 3 on the horizontal axis) with respect to the base line (point 1: average heart rate in a state of calm). During the third exercise (point 4), in which a stress factor was introduced, the average heart rate rose considerably. This stress factor was continued in the fourth exercise (point 5), where the heart rate stabilised, and also in the fifth (point 6), where a slight fall took place. In the light of this evolution, it is conceivable that longer training would have produced a sustained fall in the heart rate in that stressful situation.

Figure 2: Evolution of average heart rate during training in breathing.



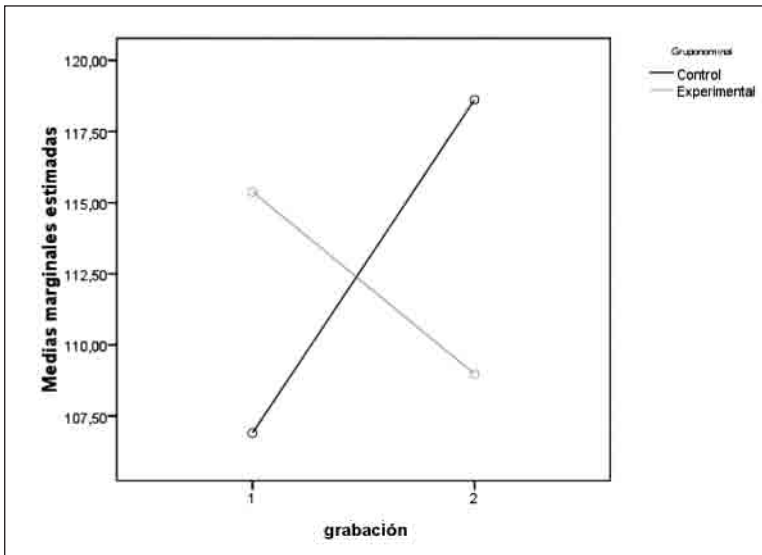
3.2. Evolution of average heart rate between the first and final recordings

A repeated-measure ANOVA with one two-level within-subject factor (first recording or final recording), and one two-level between-subject factor (experimental group or control group) was run on heart rate as the dependent variable. Given that cognitive and physiological indicators of anxiety are related (in the experimental group, correlation between heart rate and psychological state in the first recording, $r = .663$, $p = .008$; and in the second recording, $r = .870$, $p = .002$), state-anxiety and psychological state were introduced as covariates in a subsequent analysis. In this way, we eliminated the effect of these two variables on the heart rate in the ANOVA, thus isolating the possible effect of the differential training of the experimental group on the heart rate.

The results of the first analysis (ANOVA) do not show any significant effect. However, the ANCOVA reveals that the level of anxiety and the psychological state are lineally related with the heart rate. As a consequence, the interaction between the

recording and the level of anxiety during the first recording becomes significant in the ANCOVA ($p = .027$), and the interaction between the recording and the group gets close to statistical significance ($p = .053$). So, after eliminating the effect of anxiety during the first recording, which is significantly different in the two groups, it can be concluded heart rate varied differently in the two groups between the first and second recordings. Thus, observing their evolution (Figure 3), we can state that training in breathing together with biofeedback was effective in controlling the heart rate of the experimental group.

Figure 3: Evolution of the heart rate between the first and the final recordings in the experimental group and in the control group.

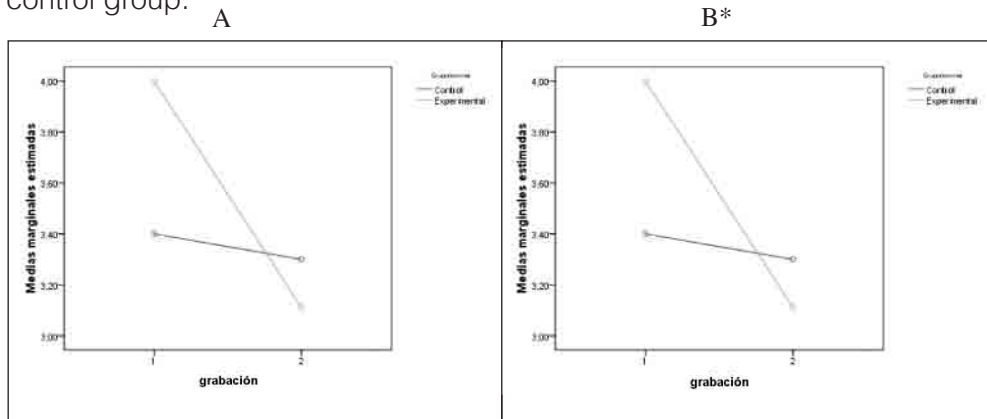


3.3. Comparison of level of anxiety and psychological state in the first and final recordings

In order to observe the evolution of anxiety and psychological state during broadcasting, a repeated-measure ANOVA with one two-level within-subject factor (first recording or final recording), and one two-level between-subject factor (experimental group or control group) was run on level of anxiety and psychological state as the dependent variables. Subsequently, the same analysis was made introducing average heart rate during the first and the final recordings as covariates. The aim of this final analysis was to determine the evolution of emotional self-control, eliminating the effect of heart rate in order to thus estimate the effectiveness of the other elements of the training program.

The first analysis shows significant effects of the recording and of the interaction between recording and group for both variables. Thus, for the whole group, anxiety fell and psychological state improved in the final recording with respect to the first recording. Besides, also for both variables, this evolution is much more pronounced for the experimental group than for the control group (Figure 4).

Figure 4: Evolution of level of anxiety (a) and psychological state (b) between the first and the final recordings in the experimental group and in the control group.



* On the scale of five points used to measure distance with respect to optimal psychological state, three is identified with this state. As can be seen from graph (b), the experimental group comes closer to that point than the control group.

The results of the ANCOVA show a significant effect of the heart rate on the level of anxiety in the first and final recordings. As a result of that, although the significant effect of the recording on the psychological state is maintained, the effect of the recording on the level of anxiety disappears. It can thus be stated that the reduction of anxiety in the second recording is related to the fall in the heart rate. The improvement in the psychological state, on the other hand, is maintained in spite of eliminating the effect of the heart rate, and must therefore be partly attributed to other elements of the training program.

The interaction between the recording and the group continues to be significant for both variables, which is why the differential evolution of the experimental group with respect to the control group must be partly attributed to the effects of other uncontrolled factors.

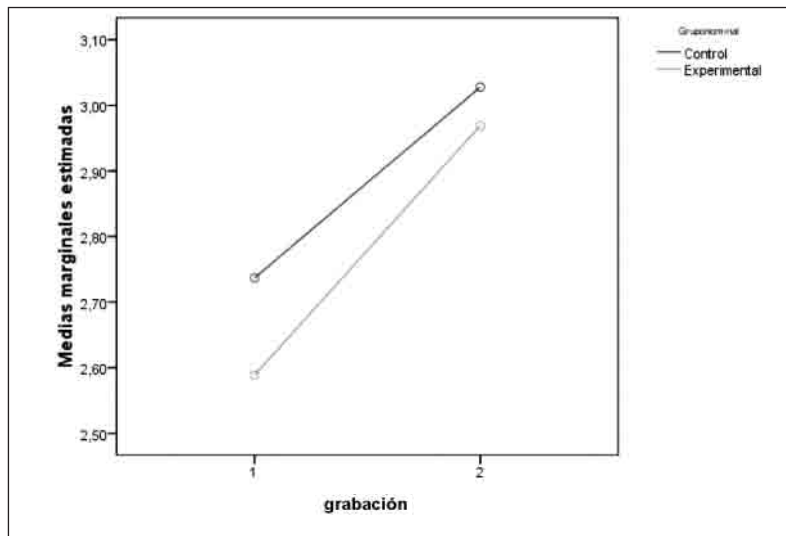
3.4. Comparison of communication quality in the first and final recordings

The second aim of the research was to verify whether, as a result of the reduction in the heart rate, there was a significant improvement in the quality of broadcasting in the second recording with respect to the first, and to see if the evolution of the experimental group was different from that of the control group. To this end, a repeated-measure ANOVA with one two-level within-subject factor (first recording or final recording), and one two-level between-subject factor (experimental group or control group) was run on communication quality as the dependent variable. Subsequently, the same analysis was made introducing state-anxiety, psychological state and heart rate as covariates. In this way, the effect of these three variables on communication quality in the ANOVA was eliminated. If, as we expected, the effect of the interac-

tion between the recording and the group on communication quality was significant in the ANOVA and ceased to be so in the ANCOVA where the effect of heart rate was controlled, this result would prove the mediating role of heart rate in the improvement of communication quality as a consequence of the treatment.

The results of the first analysis show a significant within-subjects effect of the recording variable. Thus, communication quality improves significantly in the second recording with respect to the first for the total group. Nonetheless, the between-groups effect is not significant, which means that communication quality is not significantly different for the subjects of the experimental group with respect to those of the control group, and that this quality does not vary in a different way for the two groups. The evolution of communication quality is shown in Figure 5.

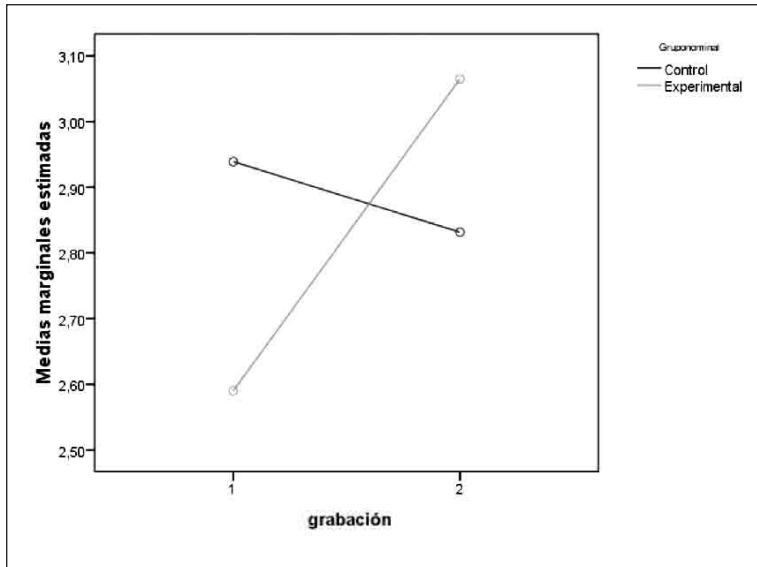
Figure 5: Evolution of communication quality between the first and the final recordings for the experimental group and for the control group.



Significant effects appear in the ANCOVA of the psychological state in the first and the final recordings ($p = .047$ and $p = .051$ respectively). As a result, the effect of the recording becomes non-significant and the effect of the group approaches statistical significance ($p = .072$). The level of anxiety in the final recording also has a significant effect on communication quality ($p = .033$), and the introduction of this covariate also results in the disappearance of the effect of the recording. Finally, no significant effect appears of heart rate on communication quality. These results indicate the mediating role of psychological state and level of anxiety on the effectiveness of the training program. On separately analysing the different items of the communication quality questionnaire (dependent variable), a significant effect appears of the interaction between the recording and heart rate in the final recording ($p = .010$) for the “clear-confusing” characteristic. So there is a greater improvement in the results in

this variable in the second recording with respect to the first for those subjects whose heart rate falls further. Figure 6 shows the evolution of this variable.

Figure 6: Evolution of the “clear-confusing” variable between the first and the final recording in the experimental group and in the control group.



4. Conclusions

Our results show that the training program obtained a general fall in anxiety while broadcasting, an approach to the optimal psychological state and an improvement in communication quality.

Training in the control of heart rate through breathing rhythm, with the aid of biofeedback, is efficient in reducing the heart level in the broadcasting situation, since the fall in the second recording is significantly greater for the experimental group than for the control group.

Heart rate is related to psychological state, both in the first and in the final recording, in the case of the experimental group, but this is not the case in the control group. It is conceivable that awareness of belonging to the experimental group, and their knowledge of the aim of evaluating the relation between heart rate and level of activation and anxiety while broadcasting, resulted in closer vigilance of their own physiological reaction and its utilisation as an indicator for judging activation level, even before the application of biofeedback.

The reduction of anxiety and the approach to the optimal psychological state is significantly greater in the experimental group than in the control group. The fall in heart rate partly explains this differential improvement, but other uncontrolled factors also contributed to these results. In spite of the subjects being randomly assigned

to the experimental and control groups, initial significant differences appear between the two groups, both in level of anxiety and in psychological state during the first recording. Given that the subjects had been previously notified about the group they would belong to, it is conceivable that this circumstance produced an increase in the level of activation and anxiety in the members of the experimental group. This difference at the outset might explain the different evolution of the two groups. For future studies, it would be convenient if the participants are unaware of the aims of the study and of the fact that they belong to an experimental group. For the time being, with our current data we can affirm that the training program has been more effective in reducing communicative anxiety in those participants with a higher initial level of anxiety.

Communication quality, externally evaluated by a group of experts, improved significantly in the second recording with respect to the first for the whole group of students. The fall in the level of communicative anxiety and the approach to the optimal psychological state are directly related to that improvement. Heart rate does not appear to be related to the overall communication quality, but it does determine one of the characteristics that make up that overall quality: the communication of those with a higher heart rate was perceived to be more confusing. There was thus a more pronounced improvement in the clarity of exposition for the participants in the experimental group.

It is worth emphasising that the training in heart rate control through breathing rhythm was efficient in spite of its short duration. Although five sessions of ten minutes were insufficient for observing a sustained fall in heart rate in a stressful situation during training, it nonetheless seems to be sufficient for learning the technique and applying it in a real broadcasting situation.

The personal accounts of the participants in their Life stories reflect a subjective experience that is congruent with our quantitative results. They establish an inversely proportional relationship between the level of stage fright and their performance in front of the cameras and microphones: *I myself tend to complicate my broadcasting due to a build up of fear which makes me speak in an increasingly low voice.*

And vice versa, a directly proportional relationship is found between confidence and performance before the cameras and microphones: *I think I've improved my pronunciation, my vocalisation, my breathing, I've learned to follow the rhythms better, to intonate phrases better, but above all I've gained in confidence.*

In a general way, all the participants agree that exposing their voice on the radio generates a tension that is more easily controllable than the exposure of one's own image – and voice – in front of television cameras and microphones: *The general commentary of all the students in the television recording room was "Please don't look at me while I'm talking..."*

In their accounts of the experience, the participants agree on a shortage in the time needed so that the improvement in their self-awareness and emotional control could be consolidated, with firmer progress in their personal communication: *Due to the small number of sessions, I haven't had much time to explore these fields more deeply, even so, it's given me the guidelines on how to do that.*

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